Ohio
Department of Rehabilitation & Correction

London Correctional Institution
DRC-23L009

Project Specifications Manual
1580 OH-56, London, Ohio 43140

LoCI Auto School Building
Ohio Department of Rehabilitation & Correction
PO Box 430 Columbus
Ohio 43216

Prepared by:

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Document 00 10 00 - Solicitation (General Contracting / Electronic Bid)
State of Ohio Standard Requirements for Public Facility Construction

Electronic bids will be received by:

Ohio Facilities Construction Commission
https://bidexpress.com

for the following Project:

LoCI Auto School Building
1580 OH-56, London, OH 43140

in accordance with the Contract Documents prepared by:

GPD Group
520 S. Main Str, Akron, OH 44311
T: 216.927.8689
F: 330.572.2101
Rick DeMarco, Project Manager
rdemarco@gpdgroup.com
gpdgroup.com
c/c: Kevin Cummings, Architectural Lead
kcummings@gpdgroup.com

In compliance with Section 153.08 of the Ohio Revised Code and Section 153:1-8-01 of the Ohio Administrative Code, Bids for this Project are being received, opened, and published through electronic means using the State's electronic bidding service.

To access this Project through the electronic bidding service, you must first register at https://bidexpress.com by clicking on the "REGISTER FOR FREE" button and following the instructions. In order to bid, you must create and enable a digital ID within the service. This process requires the submission of notarized paperwork and may take up to five business days to complete. There are no fees to register, create and enable a digital ID, or to download bid documents. There is a small expense on a monthly or per bid basis to submit a bid. The electronic bidding service offers customer support that may be reached at 888.352.2439 or via email at support@bidexpress.com.

Bidders may submit requests for consideration of a proposed Substitution for a specified product, equipment, or service to the Architect/Engineer ("A/E") no later than 10 days prior to the bid opening. Additional products, equipment, and services may be accepted as approved Substitutions only by written Addendum.

From time to time, the Commission issues new editions of the "State of Ohio Standard Requirements for Public Facility Construction" and may issue interim changes. Bidders must submit Bids that comply with the version of the Standard Requirements included in the Contract Documents.

Prevailing Wage rates and Equal Employment Opportunity requirements are applicable to this Project.

This Project is subject to the State of Ohio's Encouraging Diversity, Growth, and Equity ("EDGE") Business Development Program. A Bidder is required to submit with its Bid and with its Bidder's Qualifications form, certain information about the certified EDGE Business Enterprise(s) participating on the Project with the Bidder. Refer to **Section 6.1.10** of the **Instructions to Bidders**.

The EDGE Participation Goal for the Project is **«5.0» percent**.

For more information about EDGE certification, contact the State of Ohio, Department of Development, Minority Business Division at www.minority.ohio.gov or email certifications@development.ohio.gov.

The Bidder may be subject to a Pre-Award Affirmative Action Compliance Review in accordance with Section 123:2-5-01 of the Ohio Administrative Code including a review of the Bidder's employment records and an on-site review.

The Bidder must indicate on the electronic Bid Form, the locations where its services will be performed in the spaces provided or by attachment in accordance with the requirements of Executive Order 2019-12D related to providing services only within the United States and the requirements of Executive Order 2022-02D prohibiting purchases from or investment in any Russian institution or company. Failure to do so may cause the Bid to be rejected as non-responsive.

DOMESTIC STEEL USE REQUIREMENTS AS SPECIFIED IN OHIO REVISED CODE SECTION 153.011 APPLY TO THIS PROJECT. COPIES OF OHIO REVISED CODE SECTION 153.011 CAN BE OBTAINED FROM ANY OF THE OFFICES OF THE OHIO FACILITIES CONSTRUCTION COMMISSION.

Bidders are encouraged to be enrolled in and to be in good standing in a Substance Use Prevention and Recovery ("SUPR") Program approved by the Ohio Bureau of Workers' Compensation ("OBWC") prior to submitting a Bid and provide, on the Electronic Bid Form with its Bid, certain information relative to their enrollment in such a program; and, if awarded a Contract, shall comply with other SUPR criteria described in **Section 1.6** of the **General Conditions**.

Electronic bids will be received for:

Trade	Estimate
General Contract	**$6,975,840**
Alternate 1	**$30,000**
Alternate 2	**$95,000**
Alternate 3	**$10,000**
Alternate 4	**$45,000**
Alternate 5	**$14,000**

until **October 20, 2025**, **1pm.**, when all Bids will be electronically opened. Bid tabulations will be posted no later than 5:00 p.m. on the day Bids are opened.

All Bidders are strongly encouraged to attend the Pre-Bid Meeting on **October 1, 2025**, **9:30 am**, at the following location:

LOCI TEC Building, 1580 OH-56, London, OH 43140

***** ALL PARTIES WISHING TO ATTEND MUST REGISTER VIA EMAIL: rdemarco@gpdgroup.com***

TO ATTEND THE PRE-BID WALKTHROUGH**

THOSE REGISTERING MUST PROVIDE THE ATTENDEE'S NAME, COMPANY, AND EMAIL ADDRESS BY SEPTEMBER 26, 2025.

A MAXIMUM OF 2 PERSONS PER COMPANY WILL BE PERMITTED TO ATTEND THE IN-PERSON WALKTHROUGH.

******ALL ATTENDEES MUST AVOID TAKING PHOTOS OF INMATES******

The Contractor is responsible for scheduling the Project, coordinating the Subcontractors, and providing other services identified in the Contract Documents.

Bid advertisement will be published in the Columbus Dispatch.

The Contract Documents may be downloaded as electronic PDF files from the State's electronic bidding service at https://bidexpress.com at no charge.

END OF DOCUMENT

Document 00 21 13 - Instructions to Bidders (General Contracting / Electronic Bid)
State of Ohio Standard Requirements for Public Facility Construction

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ARTICLE 1 - GENERAL INSTRUCTIONS

1.1 Applicable Law and Forum

1.1.1 The rights of any Bidder or any party to a subsequent Contract shall be governed by the laws of the state of Ohio and only Ohio courts shall have jurisdiction over any action or proceeding related to the Bid or any subsequent Contract. The Bidder irrevocably consents to such jurisdiction.

1.2 Project Scheduling and Coordination

1.2.1 When the Contract Documents refer to a period of time by a number of days, it excludes the first day and includes the last day of the period. If the last day of the period falls on a Saturday, Sunday, or a legal holiday, that day shall be omitted and the period shall end on the next day which is not a Saturday, Sunday, or legal holiday.

1.2.2 The time for completion of the Project indicated on the electronic **Bid Form** is the time for Substantial Completion of all Work applicable to the Bidder.

1.2.3 The State may assign all or any portion of its interest in a Contract with one or more of the successful Bidders to another successful Bidder as an agreed condition for an award of the Contract for the respective Bid. The assignment may include, without limitation, the duty to schedule, coordinate, and administer the Contract.

1.2.4 The Contractor is responsible for scheduling the Project, coordinating the Subcontractors, and providing other services identified in the Contract Documents.

1.2.5 By submitting its Bid, the Bidder indicates its understanding that the Contract Sum, based on its Bid and as amended by Change Orders, includes all costs that the Contracting Authority owes the Bidder.

1.3 Written Notice

1.3.1 Notice under the Contract Documents shall be validly given if:

1.3.1.1 delivered personally to a member of the organization for whom the notice is intended;

1.3.1.2 delivered, or sent by registered or certified mail, to the last known business address of the organization; or

1.3.1.3 sent by facsimile, email, or web-based project management software, provided the original signed document is delivered within 3 business days after the date of the electronic transmission.

1.3.2 Notices provided to one Project Participant from another shall be simultaneously copied to the prospective Bidders, the Owner, the Contracting Authority, and the A/E.

1.4 Use of the State's Electronic Bidding Software

1.4.1 The Bidder shall use the State's Electronic Bidding Software to submit its Bid for this Project. Paper Bids will not be accepted.

1.4.2 Bidders, Subcontractors, and Material Suppliers may download the Contract Documents as PDF files from the State's Electronic Bidding Software at no charge by registering and associating with a company at https://bidexpress.com.

1.4.3 Bidders are encouraged to create and obtain approval of their Digital ID well in advance of the bid deadline. Approval may take up to seven business days.

1.4.4 Bidders are also encouraged to click the "Select for Bidding" link on the electronic **Bid Form** to be listed on the electronic Plan Holder's list and submit payment to receive notifications regarding Addenda and other announcements.

1.4.5 Subcontractors and Material Suppliers may view the electronic Plan Holder's list to determine potential Bidders.

1.4.6 Bidders, Subcontractors, and Material Suppliers are encouraged to attend a contractor webinar or contact the vendor's help desk through the means identified at https://bidexpress.com to increase their knowledge of using the State's Electronic Bidding Software.

ARTICLE 2 - BIDDING PROCEDURES

2.1 Examination of Contract Documents and the Site

2.1.1 Before submitting a Bid, the Bidder shall examine all Contract Documents, including, but not limited to, the Drawings, Specifications, and Addenda for all divisions of Work for the Project, noting in particular all requirements that may affect its Work in any way.

2.1.2 The Bidder's failure to become acquainted with the extent and nature of Work required to complete any portion of the Work in conformity with the requirements of the Contract Documents, shall not be a basis for additional compensation.

2.1.3 Before submitting a Bid, the Bidder should not only examine and evaluate the Site and related Project conditions where the Work will be performed, but shall also consider when the Work will be performed including, but not limited to, the following:

2.1.3.1 the condition, layout, and nature of the Site and surrounding area;

2.1.3.2 the availability and cost of labor;

2.1.3.3 the availability and cost of materials, supplies, and equipment;

2.1.3.4 the cost of temporary utilities required in the Bid;

2.1.3.5 the cost of any permit or license required by a local or regional authority having jurisdiction over the Project;

2.1.3.6 the usual weather conditions of the Project location;

2.1.3.7 conditions bearing upon transportation, disposal, handling, and storage of equipment, materials, and waste; and

2.1.3.8 subsurface and concealed physical conditions and related information provided in the Contract Documents.

2.2 Pre-Bid Meeting

2.2.1 The Bidder is encouraged to attend the pre-bid meeting, where the A/E, the Contracting Authority, and the Owner will receive questions regarding the Contract Documents. If not given in **Document 00 10 00** - **Solicitation**, the A/E shall issue notice of the time and place of any pre-bid meeting to each registered Plan Holder.

2.2.2 The A/E shall prepare minutes of the pre-bid meeting for the Project record. If questions raised by the prospective Bidders require changes to, or clarifications of, the Contract Documents, the A/E shall issue the changes by written Addendum, along with a list of pre-bid meeting attendees.

2.2.3 Additional compensation shall not be based upon the Bidder's failure to attend the pre-bid meeting, which results in the Bidder's incomplete knowledge and familiarity of the Project requirements.

2.3 Request for Interpretation

2.3.1 If the Bidder finds any perceived ambiguity, conflict, error, omission, or discrepancy within the Contract Documents, including the Drawings, Specifications, and Addenda, or between any of the Contract Documents and Applicable Law, the Bidder shall submit a written Request for Interpretation ("RFI") to the A/E for an interpretation or clarification.

2.3.1.1 The Bidder is responsible for prompt delivery of the RFI.

2.3.1.2 The A/E shall respond to RFIs received more than 7 days before the bid opening.

2.3.2 The A/E shall issue Addenda in response to RFIs that modify or clarify the Contract Documents. Any Addenda issued within 72 hours before any bid opening (excluding Saturdays, Sundays, and legal holidays) shall extend the bid opening date by 7 days pursuant to **Section 3.3.1**.

2.3.2.1 The Addenda may be delivered via the State's State's Electronic Bidding Software, facsimile or e-mail, posted to a web or FTP site, or otherwise furnished to each registered Plan Holder.

2.3.3 Any interpretation or clarification of the Contract Documents made by any Person other than the A/E, in any manner other than a written Addendum, shall not be binding, and the Bidder shall not rely upon the interpretation or clarification.

2.3.4 The successful Bidder shall not be compensated for a claim alleging insufficient data, incomplete, ambiguous, conflicting, or erroneous Contract Documents or proposed Contract Documents, or assumed conditions regarding the nature, extent, or character of the Work, if the Bidder did not submit a related RFI prior to the bid opening.

2.4 Basis of Design and Acceptable Components

2.4.1 The Contract Documents may list components produced by specific manufacturers to denote kind, quality, or performance requirements.

2.4.2 The component listed first is the Basis of Design Component.

2.4.3 Other listed components are Acceptable Components.

2.4.3.1 If the Bidder includes an Acceptable Component in its Bid, the Bidder is responsible for the costs of coordination and modification required.

2.5 Substitutions Prior to Bid Opening

2.5.1 If the Bidder proposes to use an article, device, material, equipment, form of construction, fixture, or item other than the Basis of Design or Acceptable Components named in the Specifications, the Bidder shall certify that the proposed item is equal in quality and all aspects of performance and appearance, to the item specified.

2.5.1.1 If approval of a Substitution requires changes to the Contract Documents or affects the work of other trades, the Bidder is responsible for the additional costs, including, but not limited to, changes to the design by the A/E.

2.5.2 The Bidder shall submit its request for Substitution to the A/E no later than 10 days prior to the bid opening, which must include:

2.5.2.1 the name and complete description of the proposed Substitution, including Drawings, performance and test data, and other information necessary for a complete evaluation; and

2.5.2.2 a statement setting forth any changes that the Proposed Substitution will require in the Contract Documents or the Project.

2.5.3 If the A/E approves the Proposed Substitution, the A/E shall issue an Addendum.

2.5.4 If the A/E does not approve the Proposed Substitution, the A/E shall inform the Bidder of its decision, which is final. The A/E may reject a proposed Substitution because the Bidder failed to provide sufficient information to enable the A/E to completely evaluate the Proposed Substitution without causing a delay in the bid deadline.

2.5.5 Proposed Substitutions received by the A/E less than 10 days prior to the bid deadline shall not be considered.

2.6 Electronic Bid Form

2.6.1 Each Bid shall be submitted on the electronic **Bid Form** through the State's Electronic Bidding Software.

2.6.1.1 All sections of the electronic **Bid Form**, including a completed "Bidder Affirmation and Disclosure" section acknowledging that the Bidder affirms, understands, and will abide by the requirements of Executive Order 2019-12D related to providing services only within the United States and Executive Order 2022-02D prohibiting purchases from or investment in any Russian institution or company, and a completed "Commitment to Participate in the EDGE Business Assistance Program" page, shall be submitted with the Bid. Failure to do so may cause the Bid to be rejected as non-responsive.

.1 If the names, locations, and service locations of Subcontractors are not known at the time of the Bid deadline, the Bidder must provide the information requested with its **Subcontractor and Material Supplier Declaration**.

2.6.1.2 Unless the Bidder withdraws the Bid as provided in **Article 4**, the Bidder is required to comply with all requirements of the Contract Documents, regardless of whether the Bidder had actual knowledge of the requirements and regardless of any statement or omission made by the Bidder that might indicate a contrary intention.

2.6.2 The Bidder shall fill in all relevant spaces on the electronic **Bid Form**. The State's Electronic Bidding Software will identify any incomplete required fields.

2.6.3 If the Bidder is a corporation, partnership, or sole proprietorship, an officer, partner or principal of the Bidder shall enter the legal name of the Bidder in the space provided on the electronic **Bid Form**. If the Bidder is a joint venture, an officer, partner or principal, as applicable, of each member of the joint venture shall enter the legal name of the applicable member in the space provided.

2.7 Allowances

2.7.1 If Allowances are provided on the electronic **Bid Form**, the amount of each Allowance shall be included in the Base Bid amount. Allowances shall be used solely for the purpose of determining the adjustment to the Contract Sum for the difference between the amount of the Allowance and the actual cost of the related Work provided. Allowances shall not include the Contractor's Fee.

2.8 Unit Prices

2.8.1 If Unit Prices are requested on the electronic **Bid Form**, the amount of the scheduled quantities shall be included in the Base Bid amount. Unit prices shall be used solely for the purpose of determining the adjustment to the Contract Sum for the difference between the estimated quantities on the electronic **Bid Form** and the actual quantities provided.

2.8.2 Unit Prices shall include all materials, equipment, labor, delivery, installation, and any other cost or expense, in connection with, or incidental to, the performance of that portion of the Work. Unit Prices shall not include the Contractor's Fee on account of the associated Unit Price Work. The Bidder shall submit Unit Prices for all items listed.

2.9 Alternates

2.9.1 If an Alternate is listed on the electronic **Bid Form**, the Bidder shall fill in the applicable space with a positive or negative bid amount as applicable. The Contracting Authority reserves the right to accept or reject any or all bid amounts for Alternates, in whole or in part, and in any order.

2.9.1.1 If no change in the bid amount is required, indicate "$0."

2.9.1.2 Failure to make an entry on any Alternate shall cause the Bid to be rejected as non-responsive if that Alternate is selected.

2.9.1.3 Failure to indicate a negative number will indicate the Bidder's intent to increase the Base Bid by the amount entered in the applicable space.

2.9.1.4 If an Alternate is not selected, an entry as listed in **Section 2.9.1.2** on that Alternate shall not, by itself, render a Bid non-responsive.

2.10 Submittals with Electronic Bid Form

2.10.1 The Contracting Authority shall reject a Bid as non-responsive if the Bidder fails to submit the following with the Bid:

2.10.1.1 An electronic facsimile of the Bid Guaranty as provided in **Article 5**, meeting the requirements of Ohio Revised Code ("ORC") Sections 153.54 and 153.571.

2.10.1.2 The original unaltered Bid Guaranty shall be delivered to the Contracting Authority within 3 business days after the public bid opening as provided in Ohio Administrative Code ("OAC") Section 153:1-8-01(H).

2.10.2 If the apparent low Bidder does not submit a valid Power of Attorney of the agent signing for the Surety with its Bid, the Contracting Authority shall direct the apparent low Bidder to deliver a valid and appropriate Power of Attorney to the Contracting Authority within a period determined by the Contracting Authority. The Contracting Authority shall not enter into a Contract without a valid Power of Attorney.

2.10.3 The Bidder is encouraged to submit background information with its Bid using the **Bidder's Qualifications** form and including, but not limited to, the information listed in this **Section 2.10**. If the apparent low Bidder does not submit the **Bidder's Qualifications** form and related information attached to the electronic **Bid Form**, the Bidder shall provide it upon request in accordance with **Section 3.5.4**, including, but not limited to:

2.10.3.1 the overall experience of the Bidder, including number of years in business under present and former business names;

2.10.3.2 a complete listing of all the Bidder's ongoing construction projects and a listing of construction projects which are similar in cost and type to the Project completed by the Bidder in the last 5 years. Include information of

the scope of work and value of each contract, a description of Encouraging Diversity Growth and Equity ("EDGE") participation and performance, and a project name/contact Person/address/phone number for the owner and the architect or engineer for each project;

2.10.3.3 a Certificate of Compliance with Affirmative Action Programs, issued pursuant to ORC Section 9.47, by the Equal Opportunity Coordinator of the Department of Administrative Services;

2.10.3.4 a complete listing of Affirmative Action and EDGE program violations in the last 5 years;

2.10.3.5 a complete listing of Prevailing Wage, EPA, OSHA, or other regulatory entity issues or violations in the last 5 years;

2.10.3.6 a complete listing of judgments, claims, arbitration proceedings or suits pending or outstanding in the last 5 years;

2.10.3.7 a complete listing of Drug-Free Workplace Program and Drug-Free Safety Program ("DFSP") violations in the last 5 years;

2.10.3.8 upon request of the Contracting Authority, the apparent low Bidder shall submit the following information, which is not a public record under ORC Section 149.43; and shall remain confidential, except under proper order of a court:

- **.1** an annual financial statement prepared within the 12 months prior to the bid opening by an independent licensed accounting firm; and the name, address, contact Person, and phone number of the bank normally used by the Bidder for its primary banking**;** or
- **.2** a financial report generated within 30 days prior to the bid opening from Standard and Poor, Dun and Bradstreet or a similar company acceptable to the Contracting Authority documenting the financial condition of the Bidder; and the name, address, contact Person, and phone number of the bank normally used by the Bidder for its primary banking.

2.10.3.9 a description of the Bidder's relevant facilities and major equipment, whether leased or owned;

2.10.3.10 a description of the management experience of the Bidder's project manager(s) and superintendent(s) and a comprehensive resume for each;

2.10.3.11 a description of the EDGE-certified Business Enterprises the Bidder proposes as Subcontractors for this Project by attaching a fully completed **EDGE Affidavit** form for each EDGE-certified Business Enterprise;

2.10.3.12 to support a Bond, a current and signed Certificate of Compliance issued by the Ohio Department of Insurance, showing the Surety is licensed to do business as a surety in Ohio;

2.10.3.13 a current Ohio Workers' Compensation Certificate;

2.10.3.14 if the Bidder is a foreign corporation not incorporated under the laws of Ohio, a Certificate of Good Standing from the Ohio Secretary of State; or, if the Bidder is a foreign person or partnership, evidence that the Bidder filed, with the Ohio Secretary of State, a Power of Attorney designating the Ohio Secretary of State as the Bidder's agent for the purpose of accepting service of summons in any action brought under ORC Section 153.05 or under ORC Sections 4123.01 to 4123.94, inclusive;

2.10.3.15 evidence that the Bidder is enrolled in, and in good standing in, a DFSP approved by the Ohio Bureau of Workers' Compensation ("OBWC"); and

2.10.3.16 any other data or information which the A/E may request concerning the responsibility of the Bidder, including a complete list of major Subcontractors with an estimated contract value of $200,000 or more, which the Bidder proposes to employ on the Project.

2.11 Changes in the Bid Amount

2.11.1 Any change to a previously submitted Bid shall be resubmitted through the State's Electronic Bidding Software prior to the deadline for submission of Bids.

ARTICLE 3 - BID OPENING AND EVALUATION

3.1 Delivery of Bid

3.1.1 The Bidder shall submit its Bid to the Contracting Authority prior to the time of the bid deadline.

3.1.2 Bids that are submitted after the time of the bid deadline shall not be considered.

3.2 Bid Opening

3.2.1 Electronic Bids shall be received until the time stated when all Bids shall be electronically opened and the Bid tabulation made public by posting on the State's Electronic Bidding Software.

3.2.2 The posting of Bid tabulations is for informational purposes only and is not to be construed as an acceptance or rejection of any Bid submitted.

3.2.3 The contents of the electronic **Bid Form** and its attachments are public records and shall be available for inspection, upon request, at any time after the bid deadline, except for any information that is not defined as a public record under Ohio law.

3.3 Bid Deadline Extension

3.3.1 If an Addendum is issued within 72 hours prior to the published time for the bid deadline, excluding Saturdays, Sundays and legal holidays, the bid deadline shall be extended 7 days. If the Contracting Authority approves, the bid deadline may be extended for more than 7 days, and consideration for additional advertising may be recommended.

3.3.2 As part of issuing any Addendum earlier than 72 hours prior to the published time for the bid deadline, excluding Saturdays, Sundays and legal holidays, only the Contracting Authority may approve a revised bid deadline or additional advertising.

3.4 Bid Evaluation Criteria

3.4.1 The Contracting Authority reserves the right to accept or reject any or all Bids, in whole or in part, and reserves the right to award the Contract to any remaining Bidder the Contracting Authority determines, in its sole discretion, to have submitted the lowest responsive and responsible Bid.

3.4.2 The Contracting Authority reserves the right to accept or reject any or all Alternates. Alternates may be accepted or rejected in any order.

3.4.3 If any Bidder has engaged in collusive bidding, the Contracting Authority shall reject that Bidder's Bid as non-responsible for the Contract. A collusive bidder may also be debarred from future State Contracts.

3.4.4 The Contracting Authority reserves the right to waive, or to allow any Bidder a reasonable opportunity to cure a minor irregularity or technical deficiency in a Bid, provided the irregularity or deficiency does not affect the bid amount, or otherwise give the Bidder a competitive advantage. Noncompliance with any material requirements of the Contract Documents shall cause a Bid to be rejected as non-responsive.

3.4.5 If, in the opinion of the Owner, the award of the Contract to the lowest Bidder is not in the best interest of the State, with the written consent of the Contracting Authority, the Owner may accept, in its discretion, another Bid so opened, or the Contracting Authority may reject all Bids and advertise for other Bids. The advertisement shall be for the period, in the form, and in the publications directed by the Contracting Authority.

3.5 Bid Evaluation Procedure

3.5.1 The Contract shall be awarded to the lowest responsive and responsible Bidder as determined in the discretion of the Contracting Authority, or all Bids may be rejected in accordance with Applicable Law.

3.5.1.1 In determining which Bid is the lowest, the Contracting Authority shall consider the Base Bid and the bid amounts for any Alternate, or Alternates, which the Owner decides, in its sole discretion, to accept.

3.5.1.2 The total of the bid amounts for the accepted Alternate(s) shall be added to, or deducted from, the Base Bid, as applicable, for determining the lowest Bidder.

3.5.1.3 If two Bidders submit the same bid amount and both are determined to be responsive and responsible, the Contracting Authority may select one Bidder by the flip of a coin, which shall be conducted in the presence of both Bidders and shall be final.

.1 If one of the Bidders refuses to participate in, or fails to be present at, the flip of a coin, the remaining Bidder shall be selected.

3.5.2 A Bidder for a Contract shall be considered responsive if the Bidder's Bid responds to the Contract Documents in all material respects and contains no irregularities or deviations from the Contract Documents that would affect the amount of the Bid or otherwise give the Bidder a competitive advantage.

3.5.2.1 A Bid shall be rejected as non-responsive if the Bid contains a Bid Guaranty executed by a Surety not licensed in Ohio or a Bid Guaranty that is otherwise determined to be insufficient by the Contracting Authority.

3.5.2.2 The Bidder may be subject to a Pre-Award Affirmative Action Compliance Review pursuant to OAC Section 123:2-5-01 including a review of the Bidder's employment records and an on-site review.

.1 The Bidder must submit the information requested no later than 10 days after receipt of the request. Failure to timely respond to this request for records may result in the Bidder being found non-responsive.

3.5.2.3 If the lowest Bidder is non-responsive, the Bidder shall be notified according to **Section 3.6**.

3.5.3 In determining whether a Bidder is responsible, factors to be considered include, without limitation:

3.5.3.1 preferences required by law, where applicable;

3.5.3.2 the experience of the Bidder;

3.5.3.3 the financial condition of the Bidder;

3.5.3.4 the conduct and performance of the Bidder on previous Contracts, including compliance with Equal Employment Opportunity in the Construction Industry Administrative Rules, OSHA and Prevailing Wage laws, and demonstration of good faith effort to participate in the EDGE Business Development program, or actual participation in the EDGE Business Development program, or both, as indicated in the ORC and the Ohio Administrative Code;

3.5.3.5 the facilities of the Bidder;

3.5.3.6 the management skills of the Bidder, including the capability of the Bidder to construct and manage the entire Project, including but not limited to the plumbing, fire protection, heating, ventilating and air conditioning, and electrical branches or classes of the Work; and

3.5.3.7 the Bidder's ability to execute the Contract properly, including past performance of the Bidder and the Subcontractors that the Bidder proposes to use on the Project.

3.5.4 The A/E shall obtain from the lowest responsive Bidder any information the Contracting Authority determines appropriate to consideration of factors showing responsibility. If the lowest responsive Bidder is responsible, the Contract shall be awarded to that Bidder, unless all Bids are rejected. The Bidder shall provide all requested information within 3 days of a request from the A/E**,** or a longer period, if the Contracting Authority consents in writing.

3.5.5 If the lowest responsive Bidder is not responsible, the Contracting Authority shall evaluate the next lowest Bidder according to the procedures set forth in this **Section 3.5** until the Contract is awarded, all Bids are rejected, or all responsive Bidders are determined to be not responsible.

3.6 Rejection of Bid

3.6.1 If the lowest Bidder is not responsive or responsible, the Contracting Authority shall reject the Bid and notify the Bidder in writing by Certified Mail of the finding and the reasons for the finding.

3.6.2 Ten Percent Rule.

3.6.2.1 If the lowest responsive and responsible Bid for the Contract, including the Base Bid and accepted Alternates if any, exceeds an amount 10 percent greater than the published Estimated Construction Cost for the Contract, the Contracting Authority shall reject all Bids.

3.6.3 A Bidder notified in accordance with **Section 3.6.1** may object to its rejection by filing a written protest, which must be received by the Contracting Authority within 5 days of the notification provided pursuant to **Section 3.6.1**.

3.6.4 Upon receipt of a timely protest, the Contracting Authority shall meet with the protesting Bidder to hear its objections. ORC Chapter 119 administrative hearing requirements are not applicable to the bid protest meeting**.**

3.6.4.1 No Contract award shall become final until after the Contracting Authority has met with all Bidders who have timely filed protests and the award of the Contract is affirmed by the Contracting Authority.

3.6.4.2 If all protests are rejected, the Contract shall be awarded to the lowest responsive and responsible Bidder, or all Bids shall be rejected.

3.7 Notice of Intent to Award

3.7.1 The Contracting Authority shall notify the apparent successful Bidder that upon satisfactory compliance with all conditions precedent for execution of the Contract, within the time specified, the Bidder shall be awarded the Contract.

3.7.2 The Contracting Authority reserves the right to rescind any Notice of Intent to Award if the Contracting Authority determines it issued the Notice of Intent to Award in error, or if the conditions precedent for execution of Contract set forth in **Article 6** are not met.

ARTICLE 4 - WITHDRAWAL OF BID

4.1 Withdrawal prior to Bid Opening

4.1.1 A Bidder may withdraw a Bid after submitting the Bid through the State's Electronic Bidding Software, provided the Bidder submits its request through the State's Electronic Bidding Software prior to the bid deadline.

4.2 Withdrawal after Bid Opening

4.2.1 The Bid shall remain valid and open for acceptance for a period of 60 days after the bid opening; provided, however, a Bidder may withdraw a Bid from consideration after the bid opening if the bid amount was substantially lower than the amounts of other Bids, providing the Bid was submitted in good faith, and the reason for the bid amount being substantially lower was a clerical mistake, as opposed to a judgment mistake, and was actually due to an unintentional and substantial arithmetic error or an unintentional omission of a substantial quantity of Work, labor, or material made directly in the compilation of the bid amount.

4.2.1.1 Notice of a request to withdraw a Bid shall be made in writing filed with the Contracting Authority within 2 business days after the bid opening. The Contracting Authority reserves the right to request the Bidder to submit evidence substantiating the Bidder's request to withdraw the Bid.

4.2.1.2 No Bid may be withdrawn under **Section 4.2.1** which would result in awarding a Contract involving the same item on another Bid to the same Bidder.

4.2.2 If a Bidder withdraws its Bid under **Section 4.2.1**, the Contracting Authority may award the Contract to the next lowest responsive and responsible Bidder, or reject all Bids and advertise for other Bids. In the event the Contracting Authority advertises for other Bids, the withdrawing Bidder shall pay the costs, in connection with the re-bidding, of printing new Contract Documents, required advertising, and printing and mailing of notices to prospective Bidders, if the Contracting Authority finds that these costs would not have been incurred but for the withdrawal.

4.2.3 A Bidder may withdraw the Bidder's Bid at any time after the 60-day period described in **Section 4.2.1** by giving written notice to the Contracting Authority.

4.3 Refusal to Accept Withdrawal

4.3.1 If the Contracting Authority contests the right of a Bidder to withdraw a Bid pursuant to **Section 4.2.1**, a hearing shall be held within 10 days after the bid opening and the Contracting Authority shall issue an order allowing or denying the claim of this right within 5 days after the hearing is concluded. The Contracting Authority shall give the withdrawing Bidder timely notice of the time and place of the hearing.

4.3.1.1 The Contracting Authority shall make a stenographic record of all testimony, other evidence, and rulings on the admissibility of evidence presented at the hearing. The Bidder shall pay the costs of the hearing.

4.3.1.2 Pursuant to ORC Section 119.12, the Bidder may appeal the order of the Contracting Authority required by **Section 4.3.1**.

4.4 Refusal to Perform

4.4.1 In the event the Contracting Authority denies the request for withdrawal and the Bidder refuses to perform the Contract, the Contracting Authority may reject all Bids or award the Contract to the next lowest responsive and responsible Bidder.

4.5 Effect of Withdrawal

4.5.1 A Bidder, who is permitted to withdraw a Bid under **Section 4.2.1**, shall not supply material or labor to, or perform a subcontract or other work for, the Person to whom the Contract is awarded; or otherwise benefit, directly or indirectly, from the performance of the Project for which the withdrawn Bid was submitted; without the Contracting Authority's prior written consent.

ARTICLE 5 - BID GUARANTY AND BOND

5.1 Bid Guaranty

5.1.1 The Bidder shall submit a Bid Guaranty with the Bidder's Bid, payable to the Contracting Authority, in the form of either:

5.1.1.1 the signed **Document 00 43 13** - **Bid Security Form** contained in the Contract Documents for the amount of the Base Bid plus all additive Alternates; or

5.1.1.2 a certified check, cashier's check, or letter of credit, for 10 percent of the Base Bid, plus all additive Alternates – a letter of credit shall expressly provide that it is revocable only by the Contracting Authority.

5.1.2 The Bid Guaranty shall be in form and substance satisfactory to the Contracting Authority and shall serve as an assurance that upon acceptance of the Bid, the Bidder shall comply with all conditions precedent for Contract execution, within the time specified by the Contracting Authority.

5.1.3 If the blank line on the **Bid Security Form** is not filled in, the penal sum shall be the full amount of the Base Bid plus all additive Alternates. If the blank line is filled in, the amount shall not be less than the full amount of the Base Bid plus all additive Alternates, stated in dollars and cents. A percentage is not acceptable. In the event the blank line is filled in for an amount less than the full amount of the Base Bid plus all additive alternates, the Bid shall be rejected as non-responsive.

5.1.4 An authorized agent must sign the **Bid Security Form**, and the Bidder shall provide a Power of Attorney from the Surety. A Surety authorized by the Ohio Department of Insurance to transact business in Ohio must issue the **Bid Security Form**.

5.1.5 The requirements of ORC Section 3901.86 may be applicable requiring an Ohio resident agent countersign the **Bid Security Form**. The Bidder shall determine the applicability of this provision.

5.1.6 Bid Guaranties in the form of a certified check, cashier's check, or letter of credit shall be returned to unsuccessful Bidders 60 days after the bid opening. Bid Guaranties in the form of a certified check, cashier's check, or letter of credit shall be returned to the successful Bidder upon providing **Document 00 61 13** - **Performance and Payment Bond Form** from a Surety satisfactory to the Contracting Authority.

5.2 Forfeiture of Bid Guaranty

5.2.1 If for any reason, other than as authorized by **Section 4.2.1** or **Section 5.3**, the Bidder fails to execute the Agreement, and the Contracting Authority awards the Contract to another Bidder, which the Contracting Authority determines is the lowest responsive and responsible Bidder:

5.2.1.1 The Bidder who failed to execute the Agreement is liable to the State for the difference between its Bid and the Bid of the next lowest responsive and responsible Bidder, or for a penal sum not to exceed ten percent of the bid amount, whichever is less.

5.2.2 If the Contracting Authority then awards a Contract to another Bidder, which the Contracting Authority determines is the lowest responsive and responsible Bidder and that Bidder fails or refuses to execute the Agreement:

5.2.2.1 The liability of the lowest responsive and responsible Bidder shall be the difference between the bid amount of the lowest responsive and responsible Bidder and another Bidder which the Contracting Authority determines is the lowest responsive and responsible Bidder, except as provided in **Section 5.3**, but not in excess of the liability specified in **Section 4.2.2**.

5.2.2.2 The liability on account of an award to the lowest responsive and responsible Bidder beyond the third lowest responsive and responsible Bidder shall be determined in like manner**.**

5.2.3 If the Contracting Authority does not award the Contract to another Bidder under **Section 5.2.2**, but submits the Project for re-bidding:

5.2.3.1 The Bidder failing or refusing to execute the Agreement is liable to the State for a penal sum not to exceed 10 percent of the Bidder's bid amount or the costs in connection with the resubmission of printing new Contract Documents, required advertising, and printing and mailing notices to prospective Bidders, whichever is less, except as provided in **Section 5.3**.

5.3 Exception to Forfeiture

5.3.1 A Bidder for a Contract with the State costing less than $500,000 may withdraw its Bid from consideration if its Bid for another Contract with the State for less than $500,000 has already been accepted if:

5.3.1.1 the Bidder certifies in good faith that the total amount of its current contracts is less than $500,000; and

5.3.1.2 the Bidder's Surety certifies in good faith that the Bidder is unable to perform the subsequent Contract because such performance would exceed the Bidder's bonding capacity.

5.3.2 If a Bid is withdrawn pursuant to **Section 5.3.1**:

5.3.2.1 the Contracting Authority may award the Contract to another Bidder which the Contracting Authority determines is the lowest responsive and responsible Bidder or reject all Bids and submit the Project for re-bidding; and

5.3.2.2 neither the withdrawing Bidder nor the Bidder's Surety shall be liable for the difference between the Bidder's Bid and that of the next lowest responsive and responsible Bidder for a penal sum, or for the costs of printing new Contract Documents, required advertising, and printing and mailing notices to prospective Bidders.

5.4 Bond

5.4.1 Prior to signing the Agreement, the Bidder shall provide the Bond required by law in form and substance satisfactory to the Contracting Authority, and from a Surety licensed to do business in the state of Ohio and satisfactory to the Contracting Authority.

5.4.1.1 If the Bidder provided **Document 00 43 13** - **Bid Security Form**, described in **Section 5.1.1.1**, as its Bid Guaranty then that form shall be the Bond.

5.4.1.2 If the Bidder provided another form of Bid Guaranty, described in **Section 5.1.1.2**, then **Document 00 61 13** - **Performance and Payment Bond Form**, described in **Section 5.1.6**, shall be the Bond.

5.4.1.3 The Bidder shall not be required to provide both forms described above.

5.4.2 The Bond must be in the full amount of the Contract to indemnify the State against all direct and consequential damages suffered by failure of the Contractor to perform according to the provisions of the Contract and in accordance with the Plans, Specifications, details, and bills of material therefore and pay all lawful claims of Subcontractors, Material Suppliers, and laborers for labor performed or materials furnished in performing and completing the Contract.

ARTICLE 6 - CONTRACT AWARD AND EXECUTION

6.1 Conditions Precedent for Execution of Contract

6.1.1 The successful Bidder must submit the items in this **Section 6.1** to the Contracting Authority before executing the Agreement.

6.1.2 Bond, and to support the Bond, a Certificate of Compliance issued by the Ohio Department of Insurance, showing the Surety is licensed to do business in the state of Ohio.

6.1.3 Ohio Workers' Compensation Certificate

6.1.4 Certificate of Compliance with Affirmative Action Programs, issued by the Equal Opportunity Coordinator. The form must be submitted through the Ohio Business Gateway: http://business.ohio.gov/efiling/.

6.1.5 Certificate of Insurance (ACORD form is acceptable) and copy of additional insured or loss payee endorsement. The Contracting Authority reserves the right to request and receive a certified copy of the Contractor's insurance policies.

6.1.6 If a Bidder is a foreign corporation (e.g., not incorporated under the laws of Ohio) it must submit a Certificate of Good Standing from the Ohio Secretary of State showing the right of the Bidder to do business in the state of Ohio.

6.1.7 If a Bidder is an individual or partnership, nonresident of the State, it must submit a Power of Attorney designating the Ohio Secretary of State as the Bidder's agent for accepting service of summons in any action brought under ORC Section 153.05 or under ORC Sections 4123.01 to 4123.94, inclusive.

6.1.8 Evidence that the Bidder is enrolled in, and in good standing in, a DFSP approved by the OBWC.

6.1.9 Required Notice of Unresolved Findings for Recovery.

6.1.9.1 By submitting its Bid, the Bidder warrants that it is not subject to an unresolved findings for recovery under ORC Section 9.24. ORC Section 9.24 prohibits the State from awarding a Contract to any Bidder against whom the Auditor of State has issued a finding for recovery if the finding for recovery is unresolved at the time of award. If the Contract is awarded to a Bidder subject to an unresolved finding for recovery under ORC Section 9.24, the Contract is void on its face and the Contractor shall immediately repay to the Owner any funds paid under the Contract.

6.1.10 EDGE Program – Supporting Documentation Required.

6.1.10.1 The Bidder shall provide evidence acceptable to the Contracting Authority of the Bidder's participation in the EDGE Program by contracting with EDGE-certified Business Enterprise(s) for the Project by submitting a fully completed EDGE Affidavit for each EDGE-certified Business Enterprise, by requesting a waiver or partial waiver of the advertised EDGE Program participation goal for the Project on the Bidder's company letterhead including full documentation of the Bidder's good faith effort to contract with EDGE-certified Business Enterprise(s) for this Project, or both.

6.1.11 If the Bidder is a joint venture, it must submit the executed agreement between the joint venturers describing the division of services/work and percentage of contract for each company, and a Power of Attorney which authorizes one or more individuals to bind the joint venture and each individual joint venturer to Contract Modifications.

6.2 Non-compliance with Conditions Precedent

6.2.1 The award of the Contract and execution of the Agreement require the Contractor to comply with:

6.2.1.1 all conditions precedent for execution of the Contract within 10 days of the date of the Notice of Intent to Award; and

6.2.1.2 the **Bidder's Qualifications** form, including a fully completed **EDGE Affidavit** for each EDGE-certified Business Enterprise, not previously provided within 3 business days of receiving the Contracting Authority's request.

6.2.2 Non-compliance with the conditions precedent for execution of the Contract as stated in **Section 6.1** within the timelines stated in **Section 6.2.1** following the date of the Notice of Intent to Award shall be sufficient cause to permit the Contracting Authority to cancel the Notice of Intent to Award, for the Bidder's lack of responsibility and award the Contract to another Bidder, which the Contracting Authority determines is the lowest responsive and responsible Bidder; or the Contracting Authority may re-bid the Work at its sole discretion.

6.2.3 The Contracting Authority may extend the time for complying with the conditions precedent for execution of the Contract for good cause. The extension is not a waiver of the conditions precedent for execution of the Contract.

6.3 Time Limits

6.3.1 The Contracting Authority's failure to award the Contract and execute the Agreement-within 60 days of the bid opening invalidates the entire bid process and all Bids submitted, unless the time is extended by written consent of the apparent lowest responsive and responsible Bidder and the Contracting Authority.

6.3.1.1 If the Contracting Authority awards the Contract within 60 days of the bid opening, increases in material, labor, and subcontract costs shall be borne by the Bidder.

6.3.1.2 If failure to execute the Contract within 60 days of the bid opening is due to matters for which the State is solely responsible, the Contractor is entitled to a Change Order authorizing payment of verifiable increased costs in materials, labor, or subcontracts. This increase shall not exceed the difference in price between the successful Bidder and the price of the next lowest responsive and responsible Bidder.

6.3.1.3 If failure to execute the Contract within 60 days of the bid opening is due to matters for which the Contractor is responsible, the Contracting Authority shall not grant a request for increased costs.

6.4 Notice to Proceed

6.4.1 The Contracting Authority shall issue a Notice to Proceed to the Contractor, which establishes the date for commencement and the calendar days allocated for Substantial Completion of all Work. Within 10 days of the date of the Notice to Proceed, or other period as mutually agreed by the Contractor and the Contracting Authority, the Contractor shall furnish the following submittals to the A/E:

6.4.1.1 Schedule of Values;

6.4.1.2 preliminary schedule of Shop Drawings and other Submittals;

6.4.1.3 Subcontractor and Material Supplier Declaration form, with completed "Bidder Affirmation and Disclosure" forms acknowledging that the Contractor affirms, understands, and will abide by the requirements of Executive Order 2019-12D and Executive Order 2022-02D for Subcontractors that were not identified in the electronic **Bid Form**;

6.4.1.4 qualifications of proposed project manager(s) and superintendent(s) and a comprehensive resume of each; and

6.4.1.5 evidence that an authorization agreement for automatic deposit of state warrants has been submitted to Ohio Shared Services using the electronic funds transfer form provided on the Internet at http://supplier.ohio.gov.

6.5 Prevailing Wage Rates

6.5.1 The Bidder shall base its Bid upon the prevailing rates of wages as ascertained by the Ohio Department of Commerce, Wage and Hour Bureau for the Project as provided in ORC Sections 4115.03 through 4115.14. Refer to **Document 00 73 43 - Wage Rate Requirements** for related information and the Project's prevailing rates of wages with an appropriate ratio of registered apprentices.

6.5.2 The Bidder shall not be entitled to an increase in the Contract Sum on account of an increase in prevailing wage rates, except as otherwise provided by Applicable Law. The Bidder is responsible for compliance of its Subcontractors with prevailing wage requirements.

6.5.3 Within 10 days of the date of the Notice to Proceed, the Contractor shall provide the Contracting Authority's Prevailing Wage Coordinator with a schedule of dates during the term of the Contract when the Contractor shall pay wages to its employees for the Project.

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END OF DOCUMENT

Resource International, Inc.

OHIO DEPARTMENT OF REHABILITATION AND CORRECTION
LONDON CORRECTIONAL INSTITUTION
AUTO GARAGE
LONDON, OHIO

GEOTECHNICAL INVESTIGATION REPORT

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Technology

February 28, 2025

Mr. Richard DeMarco, NCARB, AIA
Project Manager
GPD Group
1228 Euclid Avenue, Suite 320
Cleveland, Ohio 44115

Re: Geotechnical Investigation Report
Ohio Department of Rehabilitation and Correction
London Correctional Institution – Auto Garage
London, Ohio
Rii Project No. W-24-101

Dear Mr. DeMarco:

Resource International, Inc. (Rii) is pleased to submit this geotechnical investigation report for the above-referenced project. This report includes the findings of the geotechnical investigation and recommendations for the design and construction of the proposed auto garage building at the London Correctional Institution in London, Ohio.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the subsurface investigation or this report, please contact us.

Sincerely,

RESOURCE INTERNATIONAL, INC.

Johnnatan Garcia-Ruiz, Ph.D.
Staff Engineer

Jonathan P. Sterenberg, P.E.
Vice President – Geotechnical Services

Enclosure: Geotechnical Investigation Report

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1.0 INTRODUCTION

This report is a presentation of the geotechnical investigation performed for the design and construction of a new auto garage building to be located on the premises of the London Correctional Institution (LoCI) in London, Ohio. A vicinity map depicting the location of the site is provided on the boring plan in Appendix I.

Based on information provided, the proposed auto garage building is planned to be located on the west side of the correctional facility main building, within the grass area extending between the two existing service roads that run parallel to the LoCI facility's fence. It is understood that the new building will house an approximately 17,760 square-foot (sf) auto garage, which includes a 4,250 sf bus garage, a 8,920 sf car garage, and a 4,590 sf of program administration space, tool and chemical storages, classroom and restrooms. It is also understood that a mezzanine will be constructed above the administration space; however, details of the extension of the mezzanine were not available at the time of this report. In addition, the development includes two (2) parking lots on the north and south side of the proposed building with respective driveways, comprising an asphalt paved area of approximately 12,400 sf each. The entrance to the auto garage is planned to be accessed from the existing service road on the west side of the proposed building. The service road and parking lots will be connected using a concrete apron. The existing site elevation ranges from 1076 to 1084 feet. Based on the provided information, it is understood that the proposed building will have an approximate finished floor elevation (FFE) of 1082.79 feet. Therefore, up to 7.5 feet of new fill will be required in the northeastern part of the project, with minor cuts and fills (less than 3 feet) needed across the remainder of the site, to bring the area to proposed grade.

1.1 Existing Site Conditions

The LoCI facility is located off State Route 56 approximately 2.3 miles northwest of downtown London, Ohio. The project site is located within a grass area, southwest of the LoCI main building, and it is bound by existing asphalt paved service roads to the east and west of the proposed auto garage building, and by an existing building to the south. According to the topographic mapping provided by GPD Group, there is approximately 8.0 feet of relief across the proposed addition footprint. The site has a downward slope towards the northeast, with elevations ranging from 1076 to 1084 feet. Regionally, the site drains to the east towards Oak Run and towards a drainage path located west of the proposed building.

1.2 Site Geology

Physiographically, the project area lies within the Darby Plain of the Till Plains. The Darby Plain consists of broadly hummocky ground moraine with several broad, indistinct recessional moraines. Between hummocks are broad, poorly drained swales which held

wet prairies/meadows in pioneer days, with few large streams. The Darby Plains has an elevation range of 750 feet to 1100 feet, with moderately low relief.

Based on the Bedrock Geology and Topography Maps obtained from the Ohio Department of Natural Resources (ODNR), the bedrock underlying these deposits consists of the Ordovician Undivided. The Ordovician Undivided consists of various shades of gray shale with interbedded dolomite and limestone, with thin to medium bedding. This formation ranges in 145 plus feet in thickness. ODNR maps indicate that the bedrock elevation lies at an approximate elevation ranging from approximately 545 to 550 feet msl, which correspond to a bedrock depth ranging from 520 feet to 540 feet below ground surface.

2.0 SUBSURFACE INVESTIGATION

On November 10 and 11, 2024, a total of nine (9) structure borings, designated as B-01 through B-09, and four (4) pavement borings, designated as P-01 to P-04, were drilled at the locations shown on the boring plan provided in Appendix I of this report. With exception of borings B-09, the structure borings were drilled in the grass area within the proposed building footprint that was available at the time of the investigation, and were advanced to a depth of 15.0 feet below the existing ground surface. Additionally, two (2) offset borings, designated as B-03A and B-07A, were drilled in the immediate vicinity of B-03 and B-07, respectively, in order to obtain undisturbed (Shelby Tube) soil samples for further laboratory testing. Structure boring B-09 and the pavement borings were drilled within the two (2) existing service roads pavement located on the east and west side of the proposed building in accordance to the driveway and parking lot layout available at the time of the investigation. Boring B-09 was extended to 15.0 feet below grade while the pavement borings were extended to a depth of 10.0 feet below the existing grade. Additionally, five (5) pavement cores were obtained, one at each pavement boring location and one at boring B-09 location.

It should be noted that the proposed structure and pavement borings were drilled within the original proposed footprint of the auto garage building and parking lot / driveway layouts, respectively, based on the plan information available at the time of the initial mobilization. However, the layout of the proposed development was revised and provided by GPD on January 8, 2025, after the initial mobilization has been completed. Therefore, several soil borings from the investigation are located just outside the updated proposed building area at the time of this report.

A summary of soil borings information is presented in Table 1.

Table 1. Boring Summary

Originally Proposed Structure Reference [1]	Boring Number	Northing	Easting	Ground Elevation [2] (feet)	Boring Depth (feet)
Auto Garage Building	B-01	694691.850	1691592.185	1083.3	15.0
	B-02	694685.811	1691664.518	1082.8	15.0
	B-03	694757.834	1691598.851	1083.1	15.0
	B-04	694740.077	1691708.499	1079.3	15.0
	B-05	694806.184	1691657.881	1082.4	15.0
	B-06	694871.097	1691608.383	1082.9	15.0
	B-07	694851.334	1691723.097	1076.3	15.0
	B-08	694944.660	1691616.380	1081.9	15.0
	B-09	694960.983	1691729.140	1077.0	15.0
Parking Lots / Driveways	P-01	694629.986	1691549.085	1083.4	10.0
	P-02	694810.617	1691565.047	1082.7	10.0
	P-03	694562.395	1691735.248	1079.0	10.0
	P-04	694798.785	1691757.606	1076.2	10.0

1. *Although proposed for the auto garage building, borings B-01, B-02, B-04, B-06 through B-08 were also considered in the evaluation of the proposed parking lot and driveway subgrade condition.*
2. *Ground surface elevations were interpolated from topographic basemapping provided by GPD.*

The borings were field located by Rii personal using a handheld GPS unit and the available project information. The ground surface elevations at the soil boring locations were interpolated from topographic basemapping provided by GPD.

The structure and pavement borings were drilled with a truck mounted Diedrich D-50 drill rig and a Mobile B-53 drill rig, respectively, utilizing a 4.5-inch outside diameter continuous flight auger to advance the holes. Standard penetration test (SPT) and split spoon sampling were generally performed at 2.5-foot to a depth of 10.0 feet followed by 5.0-foot intervals to boring termination depths.

The SPT, per the American Society for Testing and Materials (ASTM) designation D1586, was conducted using a 140-pound hammer free falling 30 inches to drive a 2.0-inch outside diameter (O.D.) split spoon sampler for 18.0 inches. Driving resistance is recorded on the boring logs in terms of blows per 6.0-inch interval of the driving distance. The second and third intervals were added to obtain the number of blows per foot (N). SPT blow counts aid in estimating soil characteristics used to calculate bearing capacities and settlement potential. Measured blow count (N_m) values are corrected to an equivalent (60%) energy ratio, N_{60}, by the following equation. Both values are represented on the boring logs presented in Appendix III.

$$N_{60} = N_m*(ER/60)$$

Where:
N_{60} = energy corrected number of blows required to drive split spoon sampler final 12 inches in 1.5-foot sampling intervals
N_m = measured N value
ER = drill rod energy ratio, expressed as a percent, for the system used

The hammers utilized for the Diedrich D-50 and Mobile B-53 drill rigs were calibrated on March 25 and 22, 2024 and had energy ratios of 91.1 and 80.6 percent, respectively.

Hand penetrometer readings, which provide a rough estimate of the unconfined compressive strength of the cohesive soils, are reported on the boring logs in units of tons per square foot (tsf) and were utilized to classify the consistency of the cohesive soil in each layer. An indirect estimate of the unconfined compressive strength of the cohesive split spoon sample can also be made from a correlation with the blow counts (N_{60}). Please note that split spoon samples are considered to be disturbed and the laboratory determination of their shear strengths may vary from undisturbed conditions.

For instances of no recovery from standard SS interval, a 2.5-inch O.D. split spoon is driven the full length of the standard SS interval plus an additional 6.0 inches to obtain a representative sample. Only the final 6.0 inches of sample is retained. Blow counts from 2S sampling are not correlated with N_{60} values.

Upon completion of drilling, the borings were backfilled with a mixture of soil cuttings and bentonite chips. Borings in existing pavement were patched at the surface with an equivalent thickness of concrete.

During drilling, field personnel prepared field logs showing the encountered subsurface conditions. Soil samples obtained from drilling operations were preserved in sealed glass jars and delivered to the soil laboratory for classification, testing and analysis. In the laboratory, the soil samples were visually classified and selected samples were tested, as noted in Table 2.

Table 2. Laboratory Test Schedule

Laboratory Test	Test Designation	Number of Tests Performed
Moisture Content	ASTM D2216	49
Plastic and Liquid Limits	ASTM D4318	26
Gradation	ASTM D422	29
Hydrometer	ASTM D422	26
Loss on Ignition	ASTM D2974	5
Unconfined Compression	ASTM D2166	1

The tests performed are necessary to classify the existing soil using the Unified Soil Classification System (USCS) in accordance with ASTM D2487. The results are used to estimate engineering properties needed to provide foundation and pavement design recommendations and soil related construction considerations. Results of the laboratory testing are presented in Appendix IV and, in part, on the boring logs in Appendix III. A description of the soil terms used throughout this report is presented in Appendix II.

3.0 SUBSURFACE PROFILE

Interpreted engineering logs have been prepared based on the field logs, visual examination of samples and laboratory test results. Classification follows the current USCS classification system. The following is a summary of what was found in the test borings and what is represented on the boring logs.

3.1 Surface Materials

Structure borings B-01 through B-08 encountered approximately 6.0 to 8.0 inches of topsoil at the ground surface, as identified by the presence of vegetation and organic matter. Pavement borings P-01 through P-04 and structure boring B-09 encountered 6.25 to 7.75 inches of asphalt overlying 5.0 to 9.0 inches of aggregate base material. A summary of surface material information encountered at each boring is presented in Table 3.

Table 3. Surface Material Summary

Boring Number	Topsoil (in)	Asphalt Pavement (in)	Aggregate Base (in)
B-01	7.0	-	-
B-02	7.5	-	-
B-03	6.0	-	-
B-04	7.0	-	-
B-05	7.0	-	-
B-06	7.5	-	-
B-07	6.5	-	-
B-08	8.0	-	-
B-09	-	7.5	5.0
P-01	-	7.5	7.0
P-02	-	6.25	6.0
P-03	-	7.75	6.5
P-04	-	7.0	9.0

3.2 Subsurface Soils

Below the surficial materials, existing fill was encountered in borings B-01 and B-02 extending to a depth of 3.0 feet each below the existing grade, respectively. The fill was described as lean clay and sandy lean clay (USCS CL). Coal, plastic and construction debris were observed within the fill.

Underlying the surficial and fill materials, natural soils generally consisting of cohesive over granular soils were encountered to the boring termination depths. The natural cohesive soils were generally described as lean clay, sandy lean clay, lean clay with sand, sandy silty clay, fat clay, fat clay with sand, silt and sandy silt (USCS CL, CL-ML, CH and ML). The natural granular soils were generally described as clayey sand, clayey sand with gravel, silty clayey sand, silty sand with gravel, poorly graded sand with gravel, poorly graded sand with silt and gravel, well graded sand with gravel, and silty gravel (USCS SC, SC-SM, SM, SP, SP-SM, SW and GM).

The shear strength and consistency of the cohesive soils are primarily derived from the hand penetrometer values (HP). The consistency of the encountered cohesive soils ranged from soft ($0.25 < HP \leq 0.5$ tsf) to hard ($HP > 4.0$ tsf). Also, one unconfined compressive strength test was conducted on an undisturbed sample of sandy lean clay (USCS CL), obtained from boring B-03A at a depth of 8.0 feet, indicating an undrained shear strength of 2.63 tsf (very stiff). The unconfined compressive strengths of the cohesive soil samples tested, obtained from the hand penetrometer and the unconfined compressive strength test, ranged from 0.5 tsf to 4.5 tsf (limit of hand penetrometer).

The relative density of granular soils is primarily derived from SPT blow counts (N_{60}) values. Based on the SPT blow counts obtained, the relative density of the granular soils encountered ranged from loose ($4 < N_{60} \leq 10$ bpf) to dense ($30 < N_{60} \leq 50$ bpf). SPT blow counts recorded from the SPT sampling within the natural granular soils ranged from 7 to 48 bpf.

Natural moisture contents of the cohesive soil samples tested ranged from 5 to 23 percent, and moisture contents of the granular soil samples tested ranged from 8 to 13 percent. The natural moisture contents of the cohesive soil samples tested for plasticity index ranged from 10 percent below to 9 percent above their corresponding plastic limits indicating natural moisture contents which are significantly below to significantly above their estimated optimum moisture levels.

3.3 Bedrock

Bedrock was not encountered in any of the borings performed during this investigation.

3.4 Groundwater

Groundwater was encountered in borings B-01, B-07, B-08 and B-09 during drilling at depths of 13.5, 7.0, 13.5 and 6.0 feet below the ground surface, and upon completion of the drilling operations at depths of 11.0, 6.2, 11.3 and 6.0 feet, respectively. Groundwater was not encountered during or upon completion of drilling in any of the remaining borings performed during this investigation.

Please note that short-term water level readings are not necessarily an accurate indication of the actual groundwater level. In addition, groundwater levels or the presence of groundwater are considered to be dependent on seasonal fluctuations in precipitation.

A more comprehensive description of the subsurface conditions encountered during the drilling program can be found on the boring logs in Appendix III.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Data obtained from the drilling and testing program have been used to determine foundation and pavement support capabilities and the settlement potential for the soil encountered at the site. These parameters have been used to provide guidelines for the design of the structure foundation as well as the construction specifications related to the placement of foundation and general earthwork recommendations, which are discussed in the following paragraphs.

As stated, it is understood that the proposed structure will consist of a single-story, slab-on-grade building with no basement. Based on the provided plans, the FFE of the proposed building is 1082.79 feet. Therefore, it is anticipated that shallow foundations for the proposed building and car-lift structure systems will bear at approximately 1079.8 feet. It should be noted that at the time of this report, foundation loading information was not available.

Note that, if the proposed site grading and/or foundation loading information differs from what is described/considered in this report, Rii should be provided this information for our review and our report to be revised and/or amended, if necessary.

Presence of High Plasticity Soils

High plasticity soils – classified as fat clay and fat clay with sand (USCS CH) – were encountered in several borings at varying depths. Rii anticipates that at some locations these soils will be encountered at and near the shallow foundation bearing elevations and/or slab-on-grade subgrade elevations. High plasticity clay soils are more compressible in nature as compared to low to medium plasticity clay soils, and can result in excessive long-term settlement. Additionally, high plasticity soils are susceptible to volume change (shrink/swell) with the variation in moisture content. Recommendations

for mitigation of such soils are presented in the following sections

4.1 Shallow Foundation Recommendations

Based upon an evaluation of the subsurface condition encountered in borings B-01 through B-07, performed in the vicinity of the proposed auto garage structure, the soil at the anticipated bearing elevation (El. 1079.8 feet msl), will consist of newly placed engineered fill as well as natural cohesive soils described as very stiff to hard sandy lean clay, lean clay, fat clay, and fat clay with sand (USCS CL, CH).

Fat clay and fat clay with sand (USCS CH) were encountered in borings B-03 through B-05, extending to depths ranging from 5.4 to 6.5 feet below the existing ground surface (El. approximately 1073.9 to 1076.6 feet). These high plasticity soils are considered marginal, and their suitability to support the shallow foundations is highly dependent on the conditions observed during excavation of the foundations. Foundation excavations should be observed by a qualified geotechnical engineer or an experienced soils technician under the supervision of a geotechnical engineer to determine final suitability of the bearing soils. **If/where high plasticity soils are encountered and observed to be in a wet or soft condition, Rii recommends that the excavation for the proposed foundation be over-excavated to a minimum of 3.0 feet below the foundation bearing elevation**, followed by backfilling with properly placed and compacted granular engineered fill or low strength mortar (LSM).

In general, following any necessary foundation excavation or over excavation recommended above, the bearing strata should be carefully inspected as soon as possible to assure adequacy. Inadequate bearing soil (soft/loose/organic), if encountered, should be over excavated further to expose the underlying competent natural soils. The over excavations may then be backfilled with either compacted engineered fill in accordance with Section 4.5 or Item 613 Low Strength Mortar Backfill (LSM) from the ODOT Construction and Materials Specification (CMS). If engineered fill is used, the over excavations should extend down and out from the bottom of the proposed foundation edge at 45-degree plane to remove this material from the zone of influence of the structure. If ODOT Item 613 LSM is utilized as the backfill material, then excavations may follow applicable Occupational Safety and Health Administration (OSHA) standards as described in Section 4.6.

Following the recommendations provided in this report, conventional shallow footings bearing on competent natural soils or newly placed granular engineered fill at an approximate elevation of 1079.8 feet may be proportioned for a **maximum allowable bearing capacity of 2.5 kips per square foot (ksf)**. Foundations designed in accordance with the preceding recommendations would experience total settlements of less than 1.0 inch and differential settlements of less than 0.5 inches. Additional recommendations for the foundation of the shallow footings on the east side of the proposed building – pertaining to embankment settlement and slope stability – are presented in Section 4.4.2 of this report.

Footing concrete should be placed as soon as possible following footing excavation, preferably the same day, to avoid potential water related damage. Footings should be kept dry and clean until footing concrete is placed in order to minimize damage to the bearing surface.

In order to protect against frost, exterior footings (and interior footings to be subjected to freeze-thaw effects during construction) should be placed at a minimum frost depth of 36.0 inches below the adjacent exterior grade, or in accordance with local codes. A minimum width of 24.0 inches for continuous wall footings and 36.0 inches for column footings is recommended.

4.2 Slab-on-Grade Recommendations

Based on the estimated FFE of 1082.79 feet, it is anticipated that the subsurface soil at and near the anticipated slab-on-grade support elevation will consist of newly placed engineered fill as well as existing fill materials and natural cohesive soils described as very stiff to hard sandy lean clay, fat clay, and fat clay with sand (USCS CL, CH). Rii recommends that a thorough proof roll of the building pads at the anticipated slab-on-grade bearing elevation be performed, and where wet or soft, fat clays and other high plasticity soils are encountered, 24 inches of soils below the bottom of slab elevation be over-excavated followed by replacement with properly placed and compacted engineered fill in accordance with the recommendations in Section 4.5. It is recommended that slabs-on-grade floors be designed as “floating” slabs that are structurally independent of building foundations. Adequate expansion joints should be incorporated into the floor slabs near the foundations so that the slab-on-grade do not impose additional loads on the foundations. The expansion joints would also allow the foundations and floor slabs to settle independently of each other.

Provided that the slab-on-grade is prepared in accordance with Section 4.5 of this report, **a modulus of subgrade reaction, K, of 100 pci should be used in the design of concrete floor slabs**. The use of vapor barriers or capillary breaks is recommended for two reasons:

- The installation of sheet vapor barriers or capillary breaks retards moisture migration from the soil subgrade into the concrete floor slab, reducing the moisture content of the floor slab and subsequently reducing the possible problems with the adhesion of floor applications.

- In areas where no floor application will be installed, vapor barriers or granular capillary breaks will reduce the likelihood of differential shrinkage of the floor slabs that can cause floors to curl.

In accordance with ACI specifications, it is recommended to place a 6-mil visqueen capillary break over a minimum of 4.0 inches fine aggregate below concrete slabs for

administrative buildings or other lightly loaded slabs. For slabs anticipated to support vehicles, equipment, or other heavy loads, Rii recommends placing a 6-mil visqueen capillary break over a minimum 6-inch layer of clean, compacted aggregate base beneath the concrete slabs.

The subgrade soil should be thoroughly proofrolled to identify any soft, wet or weak zones prior to placement of subbase stone or concrete. Should any soft, wet or weak zones be identified, the areas should be stabilized using one of the stabilization alternatives provided in Section 4.5.

4.3 Seismic Site Classification

Based on the soil conditions at the site, as indicated by the test borings and estimated from local geological references, the seismic analysis and design procedures for the proposed structure should be based on **Site Class D** (stiff/medium dense to dense soil profile) per the current Ohio Building Code.

4.4 Pavement Subgrade Recommendations

According to a previous proposed site plan provided by GPD on September 24, 2024, only a couple of small parking lots will be located along the south and east side of the proposed building layout, the latest of which was connected to the existing service road on the east side of the project site. However, as mentioned, the proposed auto garage building footprint was updated in a site plan provided by GPD on January 8, 2025, after the field investigation had occurred and laboratory testing had been completed. Although some of the structure borings would have been still considered during the evaluation of the pavement subgrade condition, only four (4) pavement borings P-1 though P-4 were planned in accordance to the previous site plan, and were performed within the existing service roads.

However, according to the recent site plan, some of the performed structure borings are now located within the new, larger, paved parking lots and driveway areas on the south and north of the new building layout. Therefore, with exception of borings B-07, B-09, all the structure borings in addition to the pavement borings were used for the pavement subgrade evaluation, according to their proximity to their location within or near the proposed asphalt paved driveways and parking lots and concrete apron. Based on the information provided, Rii understands that the parking lots on the south and north side of the proposed auto garage will have a capacity for fourteen (14) automobiles each. In addition, based on the building footprint, a car garage with a capacity of seven (7) apparent car-lifts is proposed on the west side of the building, while a bus garage with a capacity of two (2) apparent bus-lifts is proposed on the east side of the building. At the time of this report, detailed information regarding the used and type of lift, structure system, loading information, or the used of inspection/oil pits, was not available.

Based on the proposed grading information provided, with exception of the service road on the east side of the building, the pavements within parking lots, driveways, as well as inside the car and bus garages, and along the service road on the west side of the site, have a proposed grade elevation ranging from 1082.3 to 1082.8 feet msl (average El. 1082.5 feet). Considering pavement buildups ranging from 12.0 to 14.0 inches (within parking lots, driveways, and car and bus garages), the new subgrade can be considered to be approximately 1.1 feet below proposed grade. The soil at the anticipated subgrade elevation will consist of newly placed engineered fill as well as existing fill materials, natural cohesive soils described as very stiff to hard sandy lean clay, lean clay with sand, fat clay, and fat clay with sand (USCS CL, CH), and granular material – along the service road located west of the site – described as loose to medium dense silty sand with gravel and clayey sand with gravel (USCS SM, SC).

Based on the soil conditions encountered during the drilling phase, it is estimated that the upper portions of the anticipated pavement subgrade will require some level of stabilization per the ODOT GDM. Rii recommends that a thorough proof roll of the subgrade be performed, and where wet or soft, fat clays and other high plasticity soils are encountered, 24 inches of soils below the anticipated subgrade elevation be over-excavated followed by replacement with engineering fill in accordance with ODOT Item 203.

4.4.1 Subgrade Design Considerations

The Subgrade Analysis was performed based on an assumption that the grade of the parking lots will be raised by 1.5 feet. California Bearing Ratio (CBR) values were correlated to the results of the laboratory classification testing performed on select split spoon samples obtained the borings conducted during this investigation and that were within or in the proximity of the proposed parking lots, driveways, as well as the inside the car and bus garages. The CBR is a rating of the subgrade soil that measures the load bearing capacities of the soils. CBR values for the within the project site ranged from 2 to 12. **It is recommended that pavement design be based on a CBR of 4 with a corresponding resilient modulus, M_R, of 4,800 psi**. Correlation charts indicate a modulus of subgrade reaction (K) of 100 pci and a soil support value (SSV) of 2.4.

As discussed, some of the clay soils encountered in the borings were classified as fat clay (USCS CH). This type of clay is known for its shrink-swell potential due to its high liquid limit combined with high silt and clay content, which make it susceptible to instability. Clay soils are commonly described as having a very low, low, medium, high, and very high expansion potential. Rii recommends that all the fat clays be over-excavated and completely removed to a minimum depth of 24 inches below the bottom of proposed pavement sections. The over-excavations should be backfilled with engineering fill in accordance with ODOT Item 203.

The exposed subgrade soil should be observed and probed to identify any soft, wet or weak zones prior to placement of new aggregate base or pavement materials. If the subgrade presents evidence of soft, wet or weak soils, then it is recommended that the

soils be stabilized. Where excavation and replacement with engineered fill is selected as stabilization method, and due to the weak nature of the soils, the geotextile fabric and a layer of geogrid should be placed at the bottom of the over excavation prior to the placement of the backfill materials.

Please note that the recommended CBR values assume that the fill materials utilized for the pavement subgrade in fill areas are equivalent to, or better than materials at the existing subgrade elevation. Sources of borrow material should be designated in advance of construction. The material should be tested in the laboratory to verify the soil exhibits a minimum design CBR value of 4.

Pavement design is dependent on the inclusion of adequate surface and subsurface drainage in order to maintain the compacted subgrade near optimum moisture conditions throughout the lifetime of the pavement. If underdrain systems are considered, they should be installed in accordance to the specifications presented in ODOT Item 605.

4.4.2 Embankment and Global Stability Evaluation

As mentioned, a revised proposed auto garage building layout had become available shortly after the field investigation and laboratory testing were completed. Based on the updated plan information, the proposed site grading is understood to include a new embankment on the east side of the project site. Therefore, the planned boring depths did not extend to standard depths in consideration of the evaluation of the new proposed embankment settlement and global stability analyses. However, in order to provide some guidance, Rii prepared preliminary embankment and global stability analyses of the embankment with the recommended shallow foundation, which are discussed in the following sections. The analyses should be considered preliminary as it was conducted with limited soil profile information from the performed borings. For a better assessment of the embankment settlement and global stability, additional subsurface exploration with deeper borings should be performed.

4.4.2.1 Embankment Settlement Analysis

Rii utilized a cross-section (A-A) through the center of the proposed auto garage building to determine the estimated settlement of the foundation soils due to the proposed embankment construction. The settlement analyses were performed utilizing the estimated surcharge load from the proposed fill embankment, general soil profile obtained from the field exploration and results of the laboratory tests, and estimated consolidated soil parameters based on general soil profile and lab test results. Soil profiles from borings B-05, B-04 and B-07 were utilized in settlement analyses and evaluation of the cross-section with an embankment fill height of approximately 7.5 feet. A summary of consolidation parameters used in the settlement calculations are summarized in Table 4.

Table 4. Compressibility Parameters Utilized in Settlement Analysis

Soil Type	γ (pcf)	LL (%)	C_c [1]	C_r [2]	e_o [3]	C_v [4] (ft^2/yr)	N_{60}	C' [5]
Sandy Silty Clay, Silt (USCS CL-ML, ML)	120 to 125	20 to 24	0.009 to 0.126	0.007 to 0.009	0.428 to 0.460	150	N/A	N/A
Sandy Lean Clay (USCS CL)	120	21 to 30	0.099 to 0.180	0.007 to 0.014	0.436 to 0.507	75 to 125	N/A	N/A
Fat Clay (USCS CH)	120	56	0.414	0.031	0.710	50 to 90	N/A	N/A
Clayey Sand [6] (USCS SC)	120	24	0.126	0.009	0.460	150	N/A	N/A
Silty Gravel (USCS GM)	120	N/A	N/A	N/A	N/A	N/A	33	143

1. *Per Table 26 of FHWA GEC 5.*
2. *Estimated between 7.5% to 15% of C_c per Section 5.4.2.5 of FHWA GEC 5.*
3. *Per Table 8-2 of Holtz and Kovacs (1981).*
4. *Per Figure 6-37, Section 6.14.2 of FHWA GEC 5.*
5. *Per Figure 10.6.2.4.2b-1 of 2020 AASHTO LRFD BDS.*
6. *Values used for the clayey sand (USCS SC) are based on the cohesive properties of the soil encountered in boring B-04 and laboratory testing results.*

In the analysis, the embankment was expected to have a height of approximately 7.5 feet above the existing grade, and extend through the cross-section for approximately 90 feet with a 3H:1V side slope on the east side of the embankment fill. The plan width from top to bottom of the embankment side slope is expected to extend approximately 20 feet on the east side of the embankment fill. Results of the settlement analyses indicate a total settlement of up to 0.4 inches. Time rate of settlement indicate that approximately 0.1 inch of settlement will be remaining after a period of 14 days following construction of the embankment.

4.4.2.2 Global Stability Evaluation - Embankment with Shallow Foundation

Slope stability analyses were performed to check the global stability of shallow footing foundations on the east side of the auto garage building. A cross-section based on the provided embankment and building layout and grading information was utilized in the stability analyses. Rii used the Slide2 computer software program by Rocscience utilizing Bishop Simplified method for the global stability analyses.

The soil parameters used in the stability analysis of the slope profile were estimated based on the subsurface conditions encountered in boring B-04, the results of the field and laboratory testing, Rii experience with similar project and site conditions, and

comparison of field and laboratory test with the available literatures. As per 2024 AASHTO LRFD BDS, safety against soil failure shall be evaluated by assuming the proposed shallow spread foundation as rigid body. A summary of the shear strength parameters utilized in stability analyses is provided in Table 5.

As per 2024 AASHTO LRFD BDS, overall (global) stability of foundations is satisfied if the product of the factor of safety from the slope stability output multiplied by the resistance factor φ=0.65 is greater than 1.0. Therefore, global stability is satisfied when a minimum factor of safety of 1.5 is obtained in Slide2. Based on the typical shallow footing foundation section considered, with an approximate bearing foundation elevation of 1079.8 feet (i.e. 3.0 feet below the proposed FFE), the resulting factor of safety did not satisfy the stability requirements. For an updated analysis considering the shallow footing to bear at an approximately foundation elevation of 1077.8 feet (i.e. 5.0 feet below the proposed FFE), the resulting factor of safety under drained conditions (long-term stability) and undrained (short-term stability) were greater than 1.55. **Therefore, Rii recommends that the shallow footing foundations on the east side of the building layout be extended to bear a minimum of 5.0 feet below the FFE, corresponding to an elevation at or below approximately 1077.8 feet.**

As mentioned, fat clay and fat clay with sand (USCS CH) were encountered in borings B-03 through B-05, extending to depths ranging from 5.4 to 6.5 feet below the existing ground surface (El. approximately 1073.9 to 1076.6 feet). Where encountered, Rii recommends that these soils be over-excavated to a minimum of 3.0 feet below the foundation bearing elevation, followed by backfilling with properly placed and compacted granular engineered fill or LSM.

Table 5. Shear Strength Parameters Utilized for Stability Analyses

Material Type	Unit Weight, γ (pcf)	Drained Shear Strength		Undrained Shear Strength, s_u (psf)
		Effective Friction Angle, φ' (°)	Effective Cohesion, c' (psf)	
Item 203 Embankment (Compacted Engineered Fill)	120	28	100	2,000
Stiff to Hard Sandy Silty Clay, Silt (USCS CL-ML, ML)	115 to 125	29 to 30	0 to 25	1,500 to 4,500
Very Stiff Sandy Lean Clay (USCS CL)	120	26 to 27	0	1,250 to 2,250
Stiff to Very Stiff Fat Clay (USCS CH)	115 to 120	25	0	1,500 to 2,500
Medium Dense Clayey Sand [1] (USCS SC)	120	29 to 30	0	2,000 to 3,250
Dense Silty Gravel (USCS GM)	120	34 to 35	0	0

1. *Values used for the clayey sand (USCS SC) are based on the cohesive properties of the soil encountered in boring B-04 and laboratory testing results.*

Shear strength parameters for the new embankment fill were determined in accordance with Section 502 of the ODOT GDM. Please note that the global stability analyses consider the proposed embankment will be constructed using the engineered fill with strength properties considered in Section 4.5 of this report. For any borrow source that are used as embankment backfill, the borrow source material should be tested using remolded samples prepared to simulate the required compaction and density to verify that it meets the minimum shear strength parameters for ODOT Item 203 new embankment provided in Table 5 and utilized in the slope stability analyses.

4.4.2.3 Final Embankment Considerations

If the total estimated settlement or estimated time rate of consolidation is considered unreasonable in regards to the construction of the embankments, then consideration can be given to over excavating the upper weak, compressible soils and replacing it with ODOT Item 203 embankment. Alternatively, ground improvement techniques be implemented to increase the strength of the foundation soils and reduce the settlement potential within these layers.

4.5 Construction Considerations

The site work shall conform to the local specifications. If local specifications are not available, the latest ODOT CMS should be implemented. Site preparation should begin with general clearing, including the complete removal of all topsoil, vegetation, debris, existing concrete, unsuitable existing fill materials (as determined by a geotechnical engineer or an experienced soil technician), or any otherwise unsuitable materials from within the footprint of the proposed structure.

Any existing underground utilities and/or existing structures located within the construction limits should be completely removed or relocated, as necessary, to allow the construction of proposed structure. The voids created by the removal should be filled with properly placed and compacted engineered fill.

Prior to placing engineered fill and/or the slab-on-grade, the proposed subgrade surfaces should be thoroughly proofrolled with sufficient proofrolling apparatus (preferably a fully loaded tandem axle dump truck). A geotechnical engineer or an experienced soil technician should be present during proofrolling. Deflection, cracking or rutting of the subgrade surface during a proofroll indicates inadequate subgrade stability.

Areas of excess yielding should be stabilized using one of the following options: 1) scarifying, drying and recompacting, 2) mixing wet soil with dry soil, 3) undercutting unsuitable surficial soil and replacing it with controlled engineered fill, 4) modifying the soil by adding a chemical such as lime, cement or lime kiln dust, or 5) using a geogrid subgrade reinforcement system in conjunction with granular fill. Other methods of subgrade stabilization are available and certainly may be effective (both physically and

economically) in stabilizing the soil. The adequacy of any stabilization method should be verified through the construction of a test section. All proposed subgrade surfaces should be shaped to promote positive drainage, with a minimum slope of 2 percent or 0.25 inches per foot. Adequate drainage is necessary for maintaining the stability of the subgrade. Care should be taken during final grading so that no areas of potential ponding or standing water remain at the subgrade surface.

After materials are excavated to design grade, proper control of subgrade and new fill compaction should be performed by the geotechnical engineer and/or his/her representative. Generally, materials utilized for engineered fill should free of waste construction debris and other deleterious materials and meet the following requirements:

- Maximum Dry Density per ASTM D698 > 110 pcf
- Liquid Limit < 40
- Plasticity Index < 15
- Organic Matter < 3 percent
- Maximum Particle Size < 3 inches
- Silt Content (between 0.075 and 0.005 mm) < 45 percent

Compacted granular fill shall meet the above specification and additionally shall have a maximum 35 percent passing the No. 200 sieve.

Where cuts are proposed adjacent to existing structures, underpinning the existing structure foundation(s) and/or fully bracing excavations may be necessary to avoid undermining or weakening existing foundation soils. If excavations extend below adjacent footings, monitoring of nearby existing structure(s) is recommended throughout construction to ensure that the construction procedures are not affecting them. Where/if sheet piling is required, monitoring of adjacent structures is also recommended due to the effect of vibrations from the sheet pile driving operations on the structures.

Fill soil placed for foundation support should be placed in loose lifts not to exceed 8.0 inches. Fill soil placed under structures shall be compacted to not less than 100 percent of maximum dry density obtained by a Standard Proctor Test (ASTM D698). Compaction of fill material beneath any paved section should be performed to no less than 98 percent of Standard Proctor. Fill soil containing excess moisture shall be required to dry prior to or during compaction to a moisture content not greater than 3.0 percent above or below optimum moisture levels. However, for material which displays pronounced elasticity or deformation under the action of loaded rubber tire construction equipment, the moisture content shall be reduced to optimum if necessary to secure stability. Drying of wet soil shall be expedited by the use of plows, discs, or by other approved methods when so ordered by the site geotechnical engineer. Fill soil should not be placed in a frozen condition, and fill soil should not be placed on a frozen subgrade.

Underground utilities should be bedded in crushed granular stone, such as No. 57 or No. 8 stone, extending from 4.0 inches below the pipe to the springline of the pipe or

12.0 inches above the pipe for concrete and PVC pipe, respectively. The stone will serve as a leveling course and will provide a stable working platform. Compaction of backfill material within trench excavations located beneath any structure or pavement areas should be performed at no less than 98 percent of Standard Proctor using granular backfill placed in lifts no thicker than 8.0 inches.

4.6 Excavation Considerations

All trenching and excavation procedures should follow applicable OSHA standards, including adequate safety precautions conforming to OSHA standards for the personnel installing underground lines. During excavation, if slopes cannot be laid back to OSHA Standards due to adjacent structures or other obstructions, temporary shoring or trench boxes may be required.

The following table should be utilized as a general guide for implementing OSHA guidelines when estimating excavation back slopes at the various test boring locations. Actual excavation back slopes must be field verified by qualified personnel at the time of excavation in strict accordance with OSHA guidelines.

Table 6. Excavation Back Slopes

Soil	Maximum Back Slope (H:V)	Notes
Soft to Medium Stiff Cohesive Soils	1.5 : 1.0	Above Ground Water Table and No Seepage
Stiff Cohesive	1.0 : 1.0	Above Ground Water Table and No Seepage
Very Stiff to Hard Cohesive	0.75 : 1.0	Above Ground Water Table and No Seepage
All Granular & Cohesive Soil Below Ground Water Table or with Seepage	1.5 : 1.0	None

For the soil types encountered in the borings, the “in-situ” unit weight (γ), cohesion (c), effective angle of friction (φ’), and lateral earth pressure coefficients for at-rest conditions (k_o), active conditions (k_a), and passive conditions (k_p) have been estimated and are provided in Table 7 and Table 8.

Table 7. Estimated Undrained (Short-term) Soil Parameters for Design

Soil Type	γ (pcf) [1]	c (psf)	φ'	k_a	k_o	k_p
Medium Stiff to Stiff Cohesive Soil	115	1,500	0°	N/A	N/A	N/A
Very Stiff Cohesive Soil	120	1,750	0°	N/A	N/A	N/A
Hard Cohesive Soil	125	2,500	0°	N/A	N/A	N/A
Dense Granular Soil	125	0	34°	0.28	0.44	3.53
Compacted Cohesive Engineered Fill	120	2,000	0°	N/A	N/A	N/A
Compacted Granular Engineered Fill	130	0	33°	0.30	0.46	3.39

1. *When below groundwater table, use effective unit weight, γ' = γ - 62.4 pcf and add hydrostatic water pressure.*

Table 8. Estimated Drained (Long-term) Soil Parameters for Design

Soil Type	γ (pcf) [1]	c' (psf)	φ'	k_a	k_o	k_p
Medium Stiff to Stiff Cohesive Soil	115	0	25°	0.42	0.59	2.37
Very Stiff Cohesive Soil	120	0	27°	0.39	0.56	2.56
Hard Cohesive Soil	125	0	30°	0.38	0.55	2.66
Dense Granular Soil	125	0	34°	0.28	0.44	3.53
Compacted Cohesive Engineered Fill	120	100	28°	0.36	0.53	2.77
Compacted Granular Engineered Fill	130	0	33°	0.30	0.46	3.39

1. *When below groundwater table, use effective unit weight, γ' = γ - 62.4 pcf and add hydrostatic water pressure.*

These parameters are considered appropriate for the design of all subsurface structures, and any excavation support systems. Subsurface structures (where the top of the structure is restrained from movement) should be designed based on at-rest conditions (k_o). For any temporary retaining structures (where the top of the structure is allowed to move), earth pressure distributions should be based on active conditions (k_a) and passive pressure (k_p). The values in this table have been estimated from correlation charts based on minimum standards specified for compacted engineered fill materials. These recommendations do not take into consideration the effect of any surcharge loading or a sloped ground surface (a flat surface is considered). Earth pressures on excavation support systems will be dependent on the type of sheeting and method of bracing or anchorage.

Temporary retaining structures should be designed using the undrained soil parameters provided in Table 7, and the design should follow all applicable guidelines for the type of retaining structure utilized. Permanent retaining structures should be designed using the drained soil parameters provided in Table 8. Regardless of whether the retaining structure is temporary or permanent, the effective unit weight (γ' = γ - 62.4 pcf) plus the hydrostatic

water pressure ($\gamma_w * h_w$, where h_w is the height of water behind the wall above the base of the wall) should be utilized below the design groundwater level. The lateral earth pressure coefficients should only be applied to the horizontal pressure resulting from the effective overburden pressure, and should not be applied to the hydrostatic water pressure.

4.7 Groundwater Considerations

Based on the soil borings performed for this project, groundwater is not anticipated to be encountered during construction. If groundwater is encountered, proper groundwater control should be employed and maintained to prevent disturbance to excavation bottoms consisting of cohesive soil, and to prevent the possible development of a quick or "boiling" conditions where soft silts and/or fine sands are encountered. It is preferable that the groundwater level, if encountered, be maintained at least 36.0 inches below the deepest excavation. Based on the soil conditions encountered at borings, granular seams were encountered within the layers of cohesive soils. Groundwater flow from these layers can be significant. In the case of drilled shafts, the utilization of a drilling fluid and / or casing will be required below the water table to maintain an open hole and prevent the sidewalls from collapse.

Any seepage or groundwater encountered within conventional shallow excavations at this site should be able to be controlled by pumping from temporary sumps; however, additional measures may be required depending on the seasonal fluctuations of the groundwater level. Note that determining and maintaining actual groundwater levels during construction is the responsibility of the contractor.

5.0 LIMITATIONS OF STUDY

The recommendations presented in this report are predicated upon construction inspection by a qualified soil technician under the direct supervision of a professional geotechnical engineer. Adequate testing and inspection during construction are considered necessary to assure an adequate foundation and pavement system and are part of our recommendations.

The recommendations for this project were developed utilizing soil and bedrock information obtained from the test borings that were made at the proposed site. At this time, we would like to point out that soil borings only depict the soil conditions at the specific locations and time at which they were made. The conditions at other locations on the site may differ from those occurring at the boring locations.

The conclusions and recommendations herein have been based upon the available soil information and the preliminary design details furnished by a representative of the owner of the proposed project. Any revision in the plans for the proposed construction from those anticipated in this report should be brought to the attention of the geotechnical engineer to determine whether any changes in the foundation or earthwork recommendations are

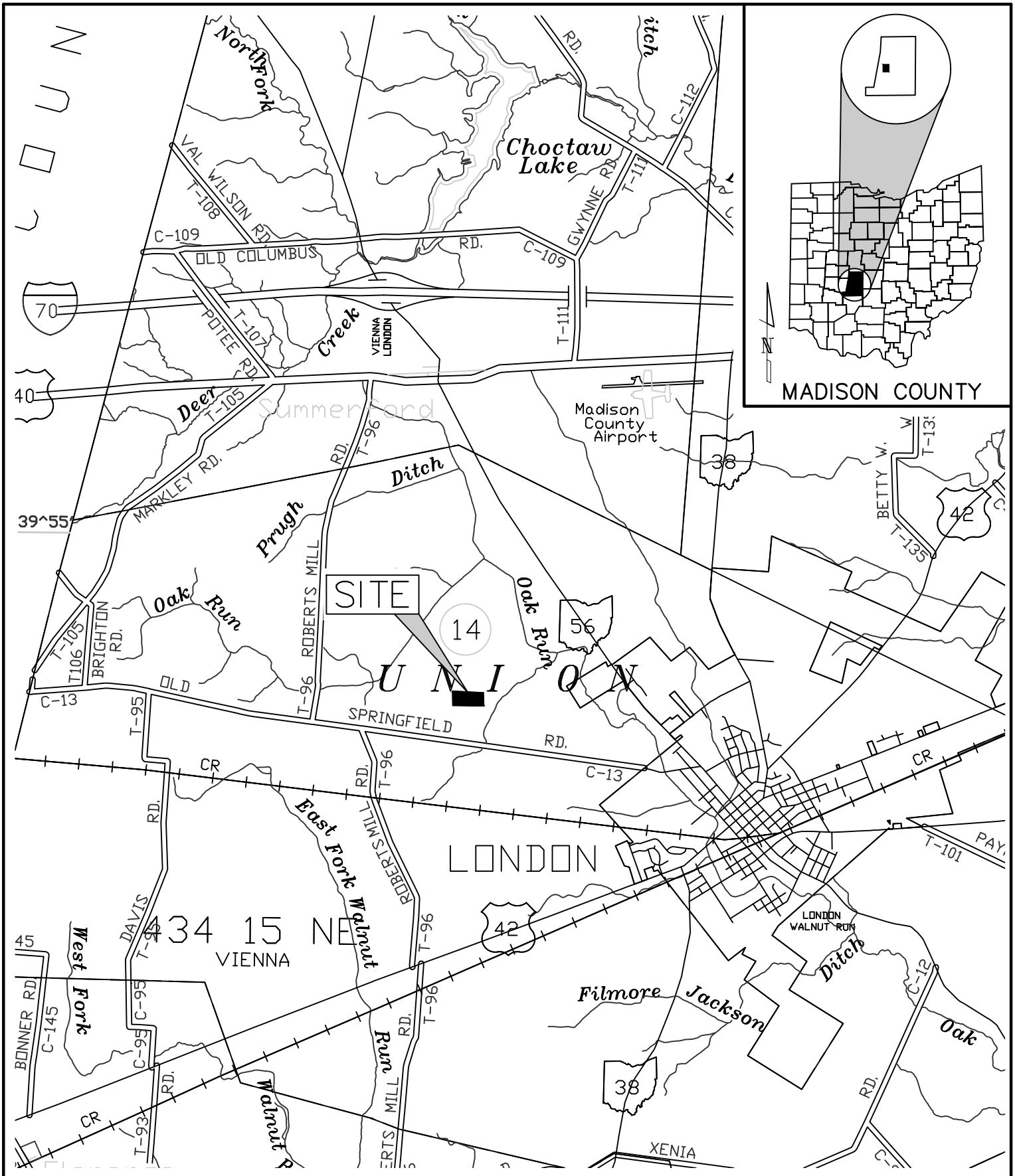
necessary. If deviations from the noted subsurface conditions are encountered during construction, they should also be brought to the attention of the geotechnical engineer.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater or surface water within or beyond the site studied. Any statements in this report or on the test boring logs regarding odors, staining of soils or other unusual conditions observed are strictly for the information of our client.

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. Resource International is not responsible for the conclusions, opinions or recommendations made by others based upon the data included.

APPENDIX I

VICINITY MAP AND BORING PLAN

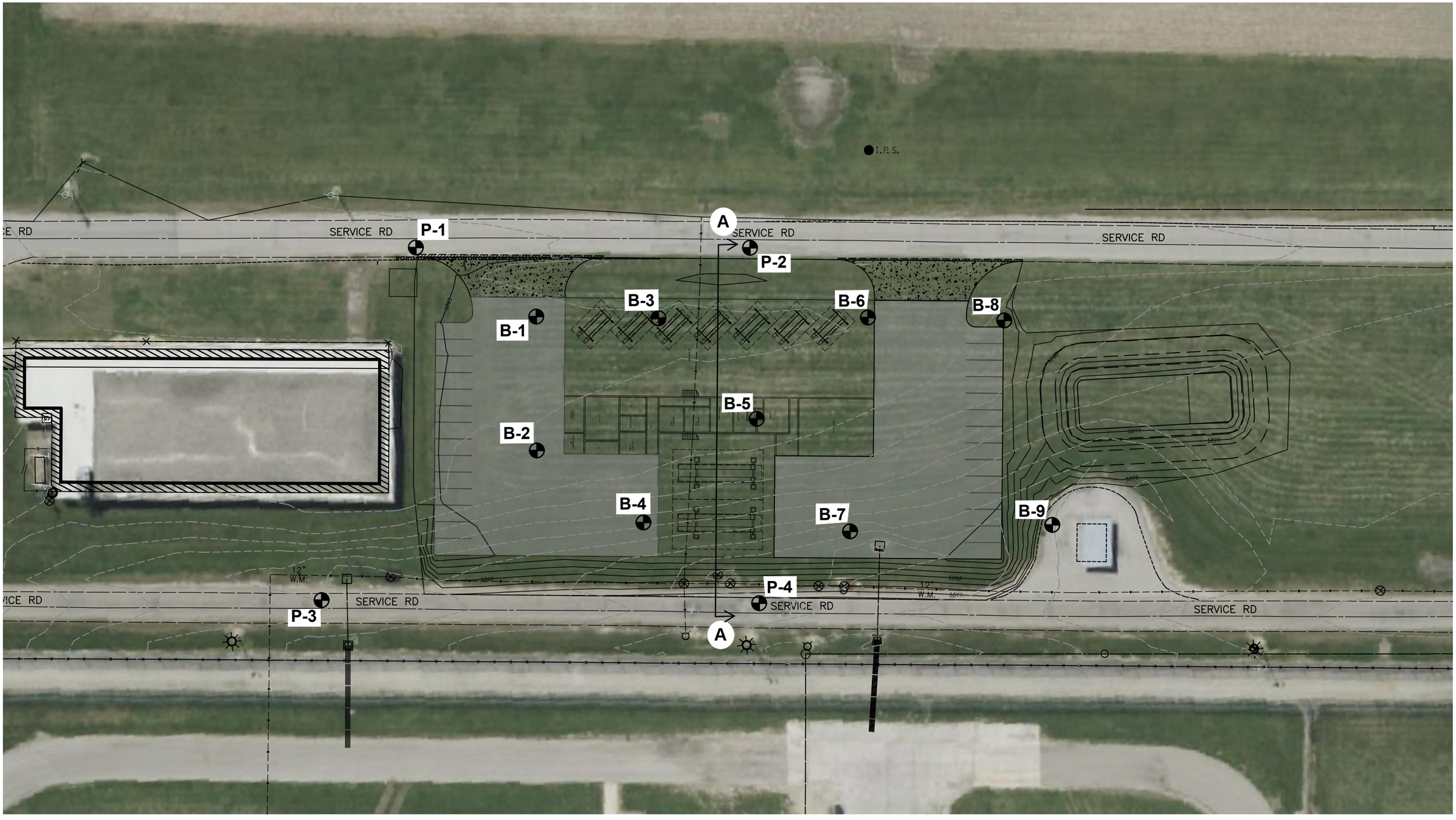


VICINITY MAP

LONDON CORRECTIONAL INSTITUTION (LOCI) - AUTO GARAGE
OHIO DEPARTMENT OF REHABILITATION AND CORRECTION (ODRC)
LONDON, OHIO

RII PROJECT NO. W-24-101	DRAWN JAS
SCALE: 1"=5000' (0 2500 5000)	REVIEWED JGR
	DATE 1/14/2025

RESOURCE INTERNATIONAL Rii



BORING PLAN

LONDON CORRECTIONAL INSTITUTION (LOCI) - AUTO GARAGE

OHIO DEPARTMENT OF REHABILITATION AND CORRECTION (ODRC)

LONDON, OHIO

RII PROJECT NO. W-24-101		DRAWN JAS
SCALE: 1"=50' (0, 25, 50)	N	REVIEWED JGR
		DATE 1/20/2025

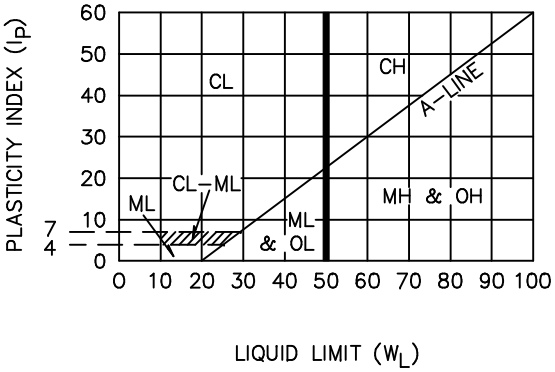
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APPENDIX II

DESCRIPTION OF SOIL AND ROCK TERMS

UNIFIED SOIL CLASSIFICATION SYSTEM
(ASTM D 2487)

MAJOR DIVISION			GROUP SYMBOLS	TYPICAL NAMES	CLASSIFICATION CRITERIA	
COARSE-GRAINED SOILS MORE THAN 50% RETAINED ON 75μm (NO. 200) SIEVE	GRAVELS 50% OR MORE OF COARSE FRACTION RETAINED ON 4.75 mm (NO. 4) SIEVE	CLEAN GRAVELS	GW	WELL-GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	CLASSIFICATION ON BASIS PERCENTAGE OF FINES LESS THAN 5% PASS 75 μm SIEVE GW, GP, SW, SP MORE THAN 12% PASS 75 μm SIEVE GM, GC, SM, SC 5% TO 12% PASS 75 μm SIEVE BORDERLINE CLASSIFICATION REQUIRING USE OF DUAL SYMBOLS	$C_U = D_{60}/D_{10}$ GREATER THAN 4 $C_Z = \frac{(D_{30})^2}{D_{10} * D_{60}}$ BETWEEN 1 AND 3
			GP	POORLY GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES		NOT MEETING BOTH CRITERIA FOR GW
		GRAVELS WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES		ATTERBERG LIMITS PLOT BELOW "A" LINE OR PLASTICITY INDEX LESS THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS PLOT ABOVE "A" LINE AND PLASTICITY INDEX GREATER THAN 7
	SANDS MORE THAN 50% OF COARSE FRACTION PASSES 4.75 mm (NO. 4) SIEVE	CLEAN SANDS	SW	WELL-GRADED SAND AND GRAVELLY SANDS, LITTLE OR NO FINES		$C_U = D_{60}/D_{10}$ GREATER THAN 6 $C_Z = \frac{(D_{30})^2}{D_{10} * D_{60}}$ BETWEEN 1 AND 3
			SP	POORLY GRADED SANDS AND GRAVELLY SANDS, LITTLE OR NO FINES		NOT MEETING BOTH CRITERIA FOR SW
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES		ATTERBERG LIMITS PLOT BELOW "A" LINE OR PLASTICITY INDEX LESS THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS PLOT ABOVE "A" LINE AND PLASTICITY INDEX GREATER THAN 7

MAJOR DIVISION		GROUP SYMBOLS	TYPICAL NAMES	CLASSIFICATION CRITERIA
FINE-GRAINED SOILS 50% OR MORE PASSES 75 μm (NO. 200) SIEVE	SILTS AND CLAYS LIQUID LIMIT 50% OR LESS	ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS	 PLASTICITY CHART FOR THE CLASSIFICATION OF FINE-GRAINED SOILS
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS	
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY	
HIGHLY ORGANIC SOILS		PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS	FIBROUS ORGANIC MATTER; WILL CHAR, BURN, OR GLOW

DESCRIPTION OF SOIL TERMS

The following terminology was used to describe soils throughout this report and is generally adapted from ASTM 2487/2488.

Granular Soils – USCS GW, GP, GM, GC, SW, SP, SM, SC, ML (non-plastic)
The relative compactness of granular soils is described as:

Description	Blows per foot – SPT (N_{60})		
Very Loose	Below		5
Loose	5	-	10
Medium Dense	11	-	30
Dense	31	-	50
Very Dense	Over		50

Cohesive Soils – USCS ML, CL, OL, MH, CH, OH, PT
The relative consistency of cohesive soils is described as:

Description	Unconfined Compression (tsf)		
Very Soft	Less than		0.25
Soft	0.25	-	0.5
Medium Stiff	0.5	-	1.0
Stiff	1.0	-	2.0
Very Stiff	2.0	-	4.0
Hard	Over		4.0

Gradation - The following size-related denominations are used to describe soils:

Soil Fraction		Size
Boulders		Larger than 12”
Cobbles		12” to 3”
Gravel	coarse	3” to ¾”
	fine	¾” to 4.75 mm (¾” to #4 Sieve)
Sand	coarse	4.75 mm to 2.0 mm (#4 to #10 Sieve)
	medium	2.0 mm to 0.42 mm (#10 to #40 Sieve)
	fine	0.42 mm to 0.074 mm (#40 to #200 Sieve)
Silt		0.074 mm to 0.005 mm (#200 to 0.005 mm)
Clay		Smaller than 0.005 mm

Modifiers of Components – The following modifiers indicate the range of percentages of the minor soil components:

Term	Range		
Trace	0%	-	10%
Little	10%	-	20%
Some	20%	-	35%
And	35%	-	50%

Moisture Table - The following moisture-related denominations are used to describe cohesive soils:

Term	Range
Dry	0% to 10%
Damp	>2% below Plastic Limit
Moist	2% below to 2% above Plastic Limit
Very Moist	>2% above Plastic Limit
Wet	≥ Liquid Limit

Organic Content – The following terms are used to describe organic soils:

Term	Organic Content (%)
Slightly organic	2-4
Moderately organic	4-10
Highly organic	>10

Bedrock – The following terms are used to describe bedrock hardness:

Term	Parameter
Very Weak	Can be carved with knife and scratched by fingernail.
Weak	Can be grooved or gouged with knife readily.
Slightly Strong	Can be grooved or gouged 0.05 in deep with knife.
Moderately Strong	Can be scratched with knife or pick.
Strong	Can be scratched with knife or pick with difficulty.
Very Strong	Cannot be scratched by knife or pick. Hard repeated blows of hammer to detach specimen.
Extremely Strong	Cannot be scratched by knife or pick. Hard repeated blows of hammer to chip hand specimen.

DESCRIPTION OF ROCK TERMS

The following terminology was used to describe the rock throughout this report and is generally adapted from ASTM D5878.

Weathering – Describes the degree of weathering of the rock mass:

Description	Field Parameter
Unweathered	No evidence of any chemical or mechanical alteration of the rock mass. Mineral crystals have a right appearance with no discoloration. Fractures show little or not staining on surfaces.
Slightly Weathered	Slight discoloration of the rock surface with minor alterations along discontinuities. Less than 10% of the rock volume presents alteration.
Moderately Weathered	Portions of the rock mass are discolored as evident by a dull appearance. Surfaces may have a pitted appearance with weathering "halos" evident. Isolated zones of varying rock strengths due to alteration may be present. 10 to 15% of the rock volume presents alterations.
Highly Weathered	Entire rock mass appears discolored and dull. Some pockets of slightly to moderately weathered rock may be present and some areas of severely weathered materials may be present.
Severely Weathered	Majority of the rock mass reduced to a soil-like state with relic rock structure discernable. Zones of more resistant rock may be present but the material can generally be molded and crumbled by hand pressures.

Strength of Bedrock – The following terms are used to describe the relative strength of bedrock:

Description	Field Parameter
Very Weak	Can be carved with knife and scratched by fingernail. Pieces 1 in. thick can be broken by finger pressure.
Weak	Can be grooved or gouged with knife readily. Small, thin pieces can be broken by finger pressure.
Slightly Strong	Can be grooved or gouged 0.05 in deep with knife. 1 in. size pieces from hard blows of geologist hammer.
Moderately Strong	Can be scratched with knife or pick. 1/4 in. size grooves or gouges from blows of geologist hammer.
Strong	Can be scratched with knife or pick with difficulty. Hard hammer blows to detach hand specimen.
Very Strong	Cannot be scratched by knife or pick. Hard repeated blows of geologist hammer to detach hand specimen.
Extremely Strong	Cannot be scratched by knife or pick. Hard repeated blows of geologist hammer to chip hand specimen.

Bedding Thickness – Description of bedding thickness as the average perpendicular distances between bedding surfaces:

Description	Thickness
Very Thick	Greater than 36 inches
Thick	18 to 36 inches
Medium	10 to 18 inches
Thin	2 to 10 inches
Very Thin	0.4 to 2 inches
Laminated	0.1 to 0.4 inches
Thinly Laminated	Less than 0.1 inches

Fracturing – Describes the degree and condition of fracturing (fault, joint, or shear):

Degree of Fracturing

Description	Spacing
Unfractured	Greater than 10 feet
Intact	3 to 10 feet
Slightly Fractured	1 to 3 feet
Moderately Fractured	Less than 1 foot

Aperture Width

Description	Width
Open	Greater than 0.2 inches
Narrow	0.05 to 0.2 inches
Tight	Less than 0.05 inches

Surface Roughness

Description	Criteria
Very Rough	Near vertical steps and ridges occur on surface
Slightly Rough	Asperities on the surfaces distinguishable
Slickensided	Surface has smooth, glassy finish, evidence of Striations

RQD – Rock Quality Designation:

RQD %	Rock Index Property Classification
0 – 25%	Very Poor
26 – 50%	Poor
51 – 70%	Fair
71 – 85%	Good
86 – 100%	Very Good

APPENDIX III

BORING LOGS

B-01 through B-09

P-01 through P-04

BORING LOGS

Definitions of Abbreviations

AS = Auger sample

HP = Unconfined compressive strength as determined by a hand penetrometer (tons per square foot)

LOI = Percent organic content (by weight) as determined by ASTM D2974 (loss on ignition test)

PID = Photo-ionization detector reading (parts per million)

QR = Unconfined compressive strength of intact rock core sample as determined by ASTM D2938 (pounds per square inch)

QU = Unconfined compressive strength of soil sample as determined by ASTM D2166 (pounds per square foot)

RC = Rock core sample

REC = Ratio of total length of recovered soil or rock to the total sample length, expressed as a percentage

RQD = Rock quality designation – estimate of the degree of jointing or fracture in a rock mass, expressed as a percentage:

$$\frac{\sum \text{segments equal to or longer than 4.0 inches}}{\text{core run length}} \times 100$$

S = Sulfate content (parts per million)

SPT = Standard penetration test blow counts, per ASTM D1586. Driving resistance recorded in terms of blows per 6-inch interval while letting a 140-pound hammer free fall 30 inches to drive a 2-inch outer diameter (O.D.) split spoon sampler a total of 18 inches. The second and third intervals are added to obtain the number of blows per foot (N_m).

N_{60} = Measured blow counts corrected to an equivalent (60 percent) energy ratio (ER) by the following equation: $N_{60} = N_m*(ER/60)$

SS = Split spoon sample

2S = For instances of no recovery from standard SS interval, a 2.5 inch O.D. split spoon is driven the full length of the standard SS interval plus an additional 6.0 inches to obtain a representative sample. Only the final 6.0 inches of sample is retained. Blow counts from 2S sampling are not correlated with N_{60} values.

3S = Same as 2S, but using a 3.0 inch O.D. split spoon sampler.

TR = Top of rock

USCS = Unified Soil Classification System per ASTM D2487

W = Seepage encountered during drilling

▽ = Initial water level measured during drilling

▼ = Water level measured at completion of drilling

Classification Test Data

Gradation (as defined on Description of Soil Terms):

GR = % Gravel
SA = % Sand
SI = % Silt
CL = % Clay

Atterberg Limits:

LL = Liquid limit
PL = Plastic limit
PI = Plasticity Index
WC = Water content (%)

RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	NORTHING 694691.850	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: Automatic	EASTING: 1691592.185	**B-01**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 1083.3 ft.	PAGE
START: 10-10-24 END: 10-10-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	COMPLETION DEPTH: 15.0 ft.	1 OF 1

ELEV. 1083.3	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GR	SA	SI	CL	LL	PL	PI	WC	USCS CLASS	BACK FILL
1082.7							0.6' - Topsoil (7.0")										
	1 2	SS-1	4 8 10	27	81	4.5+	**FILL**: Hard, dark brown **LEAN CLAY**, damp. -Trace plastic, construction debris, and organics present in SS-1									CL (V)	
1080.3	3																
	4 5	SS-2	4 8 10	27	83	4.5+	Hard, brown **LEAN CLAY**, dry.	1.4	12.8	42.3	43.5	35	16	19	9	CL	
1077.8																	
	6 7	SS-3	7 11 10	32	89	4.5+	Very stiff to hard, brown **SANDY LEAN CLAY**, damp to moist.								10	CL (V)	
	8 9 10	SS-4	3 4 5	14	89	3.5		6.3	39.2	33.4	21.1	21	13	8	11	CL	
1071.3	11																
	12 13						Dense, brown **WELL GRADED SAND WITH GRAVEL**, moist to wet.										
	14	SS-5	4 13 17	45	67											SW (V)	
1068.3	EOB 15																

NOTES: Groundwater initially encountered @ 13.5' and @ 11.0' at drilling completion. Cave-in depth @ 12.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings.

000-23 RII USCS BORING LOG - OH DOT.GDT - 11/13/24 13:11 - U:\GI8\PROJECTS\2024\W-24-101.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	NORTHING 694685.811	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: Automatic	EASTING: 1691664.518	**B-02**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 1082.8 ft.	PAGE
START: 10-11-24 END: 10-11-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	COMPLETION DEPTH: 15.0 ft.	1 OF 1

ELEV. 1082.8	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GR	SA	SI	CL	LL	PL	PI	WC	USCS CLASS	BACK FILL
1082.2							0.6' - Topsoil (7.5")										
	1	SS-1	5 7 12	28	78	4.5+	**FILL**: Hard, dark brown **SANDY LEAN CLAY**, dry to moist. -Trace organics and coal in SS-1									CL (V)	
1079.8	2 3																
	4 5	SS-2	5 10 12	33	78	4.5+	Very stiff to hard, dark brown **SANDY LEAN CLAY**, damp.	14.4	33.8	29.6	22.2	27	14	13	7	CL	
	6 7	SS-3	6 5 7	18	86	3.5										CL (V)	
1074.8	8																
	9 10	SS-4	2 3 4	10	100		Loose to medium dense, brown **SILTY, CLAYEY SAND**, moist.	12.8	38.8	30.6	17.7	20	13	7	12	SC-SM	
	11 12 13																
	14	SS-5	2 4 4	12	92												
1067.8	EOB 15														12	SC-SM (V)	

NOTES: Groundwater was not encountered during or after drilling completion. Cave-in depth @ 13.3'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings.

000-23 RII USCS BORING LOG - OH DOT.GDT - 11/13/24 13:11 - U:\GI8\PROJECTS\2024\W-24-101.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	NORTHING 694757.834	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: Automatic	EASTING: 1691598.851	**B-03**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 1083.1 ft.	PAGE
START: 10-10-24 END: 10-10-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	COMPLETION DEPTH: 15.0 ft.	1 OF 1

ELEV. 1083.1	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	*MATERIAL DESCRIPTION AND NOTES*	GR	SA	SI	CL	LL	PL	PI	WC	USCS CLASS	BACK FILL
1082.5							0.6' - Topsoil (6.0")										
	1	SS-1	3 8 9	26	67	4.5+	Very stiff to hard, dark brown **FAT CLAY WITH SAND**, damp.								15	CH (V)	
	2																
	3																
	4	SS-2	3 5 5	15	56	4.5+	-SS-2: LOI = 4.8% -Trace organics throughout	0.1	20.3	39.5	40.1	53	19	34	16	CH	
	5																
1076.6	6	SS-3A	3	14	44	3.75										CH (V)	
	7	SS-3B	4 5				Medium dense, brown **SILTY SAND**, damp.	13.1	47.0	39.9					8	SM (V)	
1075.1	8																
	9	SS-4	2 3 3	9	83		Loose to medium dense, brown **CLAYEY SAND**, moist.	14.9	36.0	30.9	18.2	22	14	8	13	SC	
	10																
	11																
	12																
	13																
	14	SS-5	4 4 6	15	100												
1068.1	EOB 15															SC (V)	

NOTES: Groundwater was not encountered during or after drilling completion. Cave-in depth @ 13.8'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings.

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	NORTHING 694753.834	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: Automatic	EASTING: 1691598.851	**B-03A**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 1083.1 ft.	PAGE 1 OF 1
START: 10-11-24 END: 10-11-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	COMPLETION DEPTH: 10.0 ft.	

ELEV. 1083.1	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	***MATERIAL DESCRIPTION AND NOTES***	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
	1 2 3 4 5 6 7 8						No Sampling										
1075.1																	
1073.1	9	ST-1			83	3.63	Brown **SANDY LEAN CLAY**, moist. -Qu @ 9.0' = 2.63 tsf								11	CL (V)	
	EOB 10																

NOTES: Groundwater was not encountered during or after drilling completion. Cave-in depth @ 10.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings.

000-23 RII USCS BORING LOG - OH DOT.GDT - 11/13/24 13:12 - U:\GI8\PROJECTS\2024\W-24-101.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	NORTHING 694740.077	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: Automatic	EASTING: 1691708.499	**B-04**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 1079.4 ft.	PAGE
START: 10-11-24 END: 10-11-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	COMPLETION DEPTH: 15.0 ft.	1 OF 1

ELEV. 1079.4	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GR	SA	SI	CL	LL	PL	PI	WC	USCS CLASS	BACK FILL
1078.8							0.6' - Topsoil (7.0")										
	1 2	SS-1	2 5 7	18	58	3.25	Very stiff, dark brown to brown **FAT CLAY**, damp to moist. -Trace organics in SS-1 -SS-1: LOI = 3.9%	1.9	13.0	40.6	44.5	56	17	39	18	CH	
	3 4 5	SS-2	4 5 8	20	53	3.25										CH (V)	
1073.9																	
	6 7	SS-3	5 6 5	16	100		Medium dense, brown **CLAYEY SAND**, moist.	13.0	37.1	28.7	21.2	24	14	10	12	SC	
	8 9	SS-4	5 9 8	26	97											SC (V)	
1067.4	10 11 12																
	13 14	SS-5	5 9 13	33	100	3.75	Very stiff, brown **SILT**, moist.								15	ML (V)	
1064.4	EOB 15																

NOTES: Groundwater was not encountered during or after drilling completion. Cave-in depth @ 11.5'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings.

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	NORTHING 694806.184	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: Automatic	EASTING: 1691657.881	**B-05**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 1082.4 ft.	PAGE
START: 10-10-24 END: 10-10-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	COMPLETION DEPTH: 15.0 ft.	1 OF 1

ELEV. 1082.4	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GR	SA	SI	CL	LL	PL	PI	WC	USCS CLASS	BACK FILL
1081.8							0.6' - Topsoil (7.0")										
	1	SS-1	2 3 5	12	61	3.0	Very stiff to hard, brown to dark brown **FAT CLAY**, moist to very moist. -Trace organics in SS-1A -Trace organics in SS-1B -SS-1B: LOI = 6.7%								19	CH (V)	
	2																
	3																
	4	SS-2	3 3 6	14	61	4.5		0.1	11.4	43.3	45.2	53	16	37	18	CH	
	5																
1075.9	6	SS-3A	4	16	92	4.5										CH (V)	
	7	SS-3B	6 5			3.5	Very stiff, brown **SANDY LEAN CLAY**, damp to moist.								13	CL (V)	
	8																
	9	SS-4	2 4 5	14	69	2.5		9.5	35.4	32.1	23.0	26	15	11	10	CL	
	10																
	11																
1070.4	12																
	13						Stiff, brownish gray **SANDY SILT**, moist.										
	14	SS-5	2 3 5	12	94	1.75										ML (V)	
1067.4	EOB 15																

NOTES: Groundwater was not encountered during or after drilling completion. Cave-in depth @ 11.7'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings.

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	NORTHING 694871.097	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: Automatic	EASTING: 1691608.383	**B-06**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 1082.9 ft.	PAGE
START: 10-10-24 END: 10-10-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	COMPLETION DEPTH: 15.0 ft.	1 OF 1

ELEV. 1082.9	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GR	SA	SI	CL	LL	PL	PI	WC	USCS CLASS	BACK FILL
1082.3							0.6' - Topsoil (7.5")										
	1 2	SS-1	5 8 7	22	58	4.25	Hard, dark brown **SANDY LEAN CLAY**, damp to moist. -Trace organics in SS-1 -SS-1: LOI = 4.4% - Cobbles present @ 2.0' and 3.25'								13	CL (V)	
	3 4 5	SS-2	8 10 10	30	94	4.5+		7.2	39.1	31.5	22.2	23	14	9	10	CL	
1077.4																	
	6 7	SS-3	5 7 9	24	89	3.25	Stiff to very stiff, brown **SANDY SILTY CLAY**, moist.									CL-ML (V)	
	8 9 10	SS-4	2 4 6	15	94	2.0		5.9	39.4	35.9	18.8	20	14	6	12	CL-ML	
1070.9																	
	11 12 13						Very stiff, brownish gray **SANDY SILT**, moist.										
	14	SS-5	4 6 6	18	83	3.75										ML (V)	
1067.9	EOB 15																

NOTES: Groundwater was not encountered during or after drilling completion. Cave-in depth @ 13.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings.

000-23 RII USCS BORING LOG - OH DOT.GDT - 11/13/24 13:12 - U:\GI8\PROJECTS\2024\W-24-101.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	NORTHING 694851.334	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: Automatic	EASTING: 1691723.097	**B-07**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 1076.3 ft.	PAGE
START: 10-10-24 END: 10-10-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	COMPLETION DEPTH: 15.0 ft.	1 OF 1

ELEV. 1076.3	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GR	SA	SI	CL	LL	PL	PI	WC	USCS CLASS	BACK FILL
1075.8							0.5' - Topsoil (6.5")										
	1	SS-1	2 6 6	18	67	2.5	Very stiff, brown **SANDY LEAN CLAY**, moist to very moist.	7.5	42.2	28.8	21.5	30	14	16	23	CL	
	2						-SS-1: LOI = 2.5%										
	3																
	4	SS-2	2 2 5	10	83	2.25		3.5	36.0	39.7	20.7	21	13	8	13	CL	
	5																
	6																
1069.3	7	SS-3A	4 12	42	78	2.25										CL (V)	
		SS-3B	16				Dense, brown **SILTY GRAVEL**, moist to wet.	49.7	34.6	15.7					11	GM (V)	
	8																
1067.3	9	SS-4A	4													GM (V)	
		SS-4B	11 11	33	72	4.5+	Hard, brown **SANDY SILTY CLAY**, moist to wet.								10	CL-ML (V)	
	10																
	11																
	12																
	13																
	14	SS-5	9 11 13	36	83	4.5+											
1061.3	15 EOB															CL-ML (V)	

NOTES: Groundwater initially encountered @ 7.0' and @ 6.2' at drilling completion. Cave-in depth @ 9.9'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings.

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	NORTHING 694848.834	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: Automatic	EASTING: 1691723.097	**B-07A**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 1075.8 ft.	PAGE 1 OF 1
START: 10-10-24 END: 10-10-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	COMPLETION DEPTH: 5.0 ft.	

ELEV. 1075.8	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	***MATERIAL DESCRIPTION AND NOTES***	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
1072.8	0						No Sampling										
1070.8	3 – 5 EOB	ST-1			88	4.13	Brown **SANDY LEAN CLAY**, moist.								11	CL (V)	

NOTES: Groundwater was not encountered during or after drilling completion. Cave-in depth @ 5.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings.

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	NORTHING 694944.660	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: Automatic	EASTING: 1691616.380	**B-08**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 1081.9 ft.	PAGE
START: 10-10-24 END: 10-10-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	COMPLETION DEPTH: 15.0 ft.	1 OF 1

ELEV. 1081.9	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GR	SA	SI	CL	LL	PL	PI	WC	USCS CLASS	BACK FILL
1081.2							0.7' - Topsoil (8.0")										
	1 2	SS-1	3 4 7	16	81	3.75	Very stiff, dark brown **LEAN CLAY WITH SAND**, very moist.	0.6	15.7	49.1	34.7	36	16	20	21	CL	
1078.9	3																
	4 5	SS-2	7 10 13	34	78	4.5+	Stiff to hard, brown **SANDY SILTY CLAY**, damp to moist.									CL-ML (V)	
	6 7	SS-3	4 4 6	15	86	3.0									11	CL-ML (V)	
	8 9	SS-4	3 3 6	14	94	1.5		5.5	32.4	41.3	20.9	20	14	6	13	CL-ML	
1069.9	10 11 12																
1067.9	13	SS-5A	18				Medium dense, brown **POORLY GRADED SAND WITH GRAVEL**, moist to wet.									SP (V)	
1066.9	EOB 14 15	SS-5B	16 16	48	89	4.0	Very stiff, brown **SILT**, moist to wet.									ML (V)	

NOTES: Groundwater initially encountered @ 13.5' and @ 11.3' at drilling completion. Cave-in depth @ 12.1'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings.

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / IS	DRILL RIG: DIEDRICH D-50 (# 313)	NORTHING 694960.983	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / BH	HAMMER: Automatic	EASTING: 1691729.140	**B-09**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/25/24	ELEVATION: 1077.0 ft.	PAGE
START: 10-11-24 END: 10-11-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90	COMPLETION DEPTH: 15.0 ft.	1 OF 1

ELEV. 1077.0	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GR	SA	SI	CL	LL	PL	PI	WC	USCS CLASS	BACK FILL
1076.4							0.6' - Asphalt (7.5")										
1076.0							0.4' - Aggregate Base (5.0")										
	1	SS-1	5 9 8	26	75	4.25	Hard, brown **SANDY SILTY CLAY**, dry.	5.3	40.7	35.7	18.3	19	12	7	9	CL-ML	
1074.0	2																
	3																
	4	SS-2	2 3 5	12	83	1.75	Stiff, brown **LEAN CLAY WITH SAND**, moist.	9.8	39.2	34.5	16.6	21	13	8	14	CL	
1071.5	5																
	6 ▼	SS-3A	8 12 9	32	94		Dense, brown **POORLY GRADED SAND WITH SILT AND GRAVEL**, moist to wet.	24.5	64.4	11.1					12	SP-SM (V)	
1069.7	7	SS-3B				4.5+	Very stiff to hard, brown to brownish gray **SILT**, moist to wet.								11	ML (V)	
	8																
	9	SS-4	5 6 8	21	0												
	10	2S-4A	12	-	100	2.25										ML (V)	
	11																
	12																
	13																
	14	SS-5A	3 4 8	18	89	2.75										ML (V)	
1062.0	EOB 15	SS-5B														ML (V)	

NOTES: Groundwater initially encountered @ 6.0' and @ 6.0' at drilling completion. Cave-in depth @ 13.5'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings. Pavement patched with concrete.

000-23 RII USCS BORING LOG - OH DOT.GDT - 11/13/24 13:12 - U:\GI8\PROJECTS\2024\W-24-101.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / SD	DRILL RIG: MOBILE B53 (62440)	NORTHING 694629.986	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / DB	HAMMER: Automatic	EASTING: 1691549.085	**P-01**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/24	ELEVATION: 1083.4 ft.	PAGE
START: 10-11-24 END: 10-11-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 80.6	COMPLETION DEPTH: 10.0 ft.	1 OF 1

ELEV. 1083.4	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
1082.8							0.6' - Asphalt (7.5")										
1082.2							0.6' - Aggregate Base (7.0")										
	1 2	SS-1	28 14 5	26	67		Medium dense, brown **SILTY SAND WITH GRAVEL**, dry.	30.2	46.3	17.2	6.3	18	15	3	5	SM	
1080.4	3																
	4 5	SS-2	2 3 7	13	67	1.75	Stiff to very stiff, brown **LEAN CLAY WITH SAND**, damp to moist.	1.8	20.9	41.0	36.2	38	15	23	17	CL	
	6 7	SS-3	4 6 7	17	94	3.5									11	CL (V)	
	8 9	SS-4	2 3 5	11	94	2.0									12	CL (V)	
1073.4	EOB 10																

NOTES: Groundwater not encountered during or after drilling completion.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings. Pavement patched with concrete.

000-23 RII USCS BORING LOG - OH DOT.GDT - 11/13/24 13:12 - U:\GI8\PROJECTS\2024\W-24-101.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / SD	DRILL RIG: MOBILE B53 (62440)	NORTHING 694810.617	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / DB	HAMMER: Automatic	EASTING: 1691565.047	**P-02**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/24	ELEVATION: 1082.7 ft.	PAGE 1 OF 1
START: 10-11-24 END: 10-11-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 80.6	COMPLETION DEPTH: 10.0 ft.	

ELEV. 1082.7	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
1082.2							0.5' - Asphalt (6.25")										
1081.7							0.5' - Aggregate Base (6.0")										
	1 2	SS-1	12 4 2	8	89		Loose, brown **CLAYEY SAND WITH GRAVEL**, moist.	24.5	36.4	23.7	15.4	23	14	9	13	SC	
1079.7	3																
	4 5	SS-2	1 2 3	7	67	1.25	Soft to stiff, brown **FAT CLAY WITH SAND**, damp to very moist.	0.3	17.7	37.1	44.9	51	17	34	22	CH	
	6 7	SS-3	0 1 2	4	64	0.5									16	CH (V)	
	8 9	SS-4	2 2 3	7	39	1.5									13	CH (V)	
1072.7	EOB 10																

NOTES: Groundwater not encountered during or after drilling completion.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings. Pavement patched with concrete.

000-23 RII USCS BORING LOG - OH DOT.GDT - 11/13/24 13:12 - U:\GI8\PROJECTS\2024\W-24-101.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / SD	DRILL RIG: MOBILE B53 (62440)	NORTHING 694562.395	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / DB	HAMMER: Automatic	EASTING: 1691735.248	**P-03**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/24	ELEVATION: 1079.0 ft.	PAGE
START: 10-11-24 END: 10-11-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 80.6	COMPLETION DEPTH: 10.0 ft.	1 OF 1

ELEV. 1079.0	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GR	SA	SI	CL	LL	PL	PI	WC	USCS CLASS	BACK FILL
1078.4							0.6' - Asphalt (7.75")										
1077.9							0.5' - Aggregate Base (6.5")										
	1	SS-1	5 9 8	23	78	4.5	Hard, brown **SANDY LEAN CLAY**, damp.	3.6	44.9	30.9	20.7	21	13	8	11	CL	
1076.0	2																
	3																
	4	SS-2	2 4 4	11	89		Loose to medium dense, brown **CLAYEY SAND**, damp.	13.7	36.3	32.4	17.6	21	13	8	12	SC	
	5																
	6																
	7	SS-3	1 2 3	7	94										12	SC (V)	
1071.0	8																
	9	SS-4	2 7 14	28	72	4.5	Hard, brownish gray **SILT**, moist.								16	ML (V)	
1069.0	EOB 10																

NOTES: Groundwater not encountered during or after drilling completion.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings. Pavement patched with concrete.

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-24-101	DRILLING FIRM / OPERATOR: RII / SD	DRILL RIG: MOBILE B53 (62440)	NORTHING 694798.785	**EXPLORATION ID**
NAME: ODRC London Correctional Institution - Auto Garage	SAMPLING FIRM / LOGGER: RII / DB	HAMMER: Automatic	EASTING: 1691757.606	**P-04**
CLIENT: GPD Group	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 3/22/24	ELEVATION: 1076.2 ft.	PAGE 1 OF 1
START: 10-11-24 END: 10-11-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 80.6	COMPLETION DEPTH: 10.0 ft.	

ELEV. 1076.2	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
1075.6							0.6' - Asphalt (7.0")										
1074.8							0.8' - Aggregate Base (9.0")										
	1–2	SS-1	7 7 13	27	89	4.5	Very stiff to hard, brown to brownish gray **SANDY LEAN CLAY**, dry to moist.	6.1	39.3	32.1	22.5	22	13	9	9	CL	
	3																
	4–5	SS-2	3 4 5	12	0												
	5	2S-2A	11	-	100	2.25		9.5	33.0	36.0	21.4	22	13	9	10	CL	
	6–7	SS-3	3 5 5	13	69	3.75									11	CL (V)	
	8																
	9–10	SS-4	8 11 10	28	69	4.5									9	CL (V)	
1066.2	EOB																

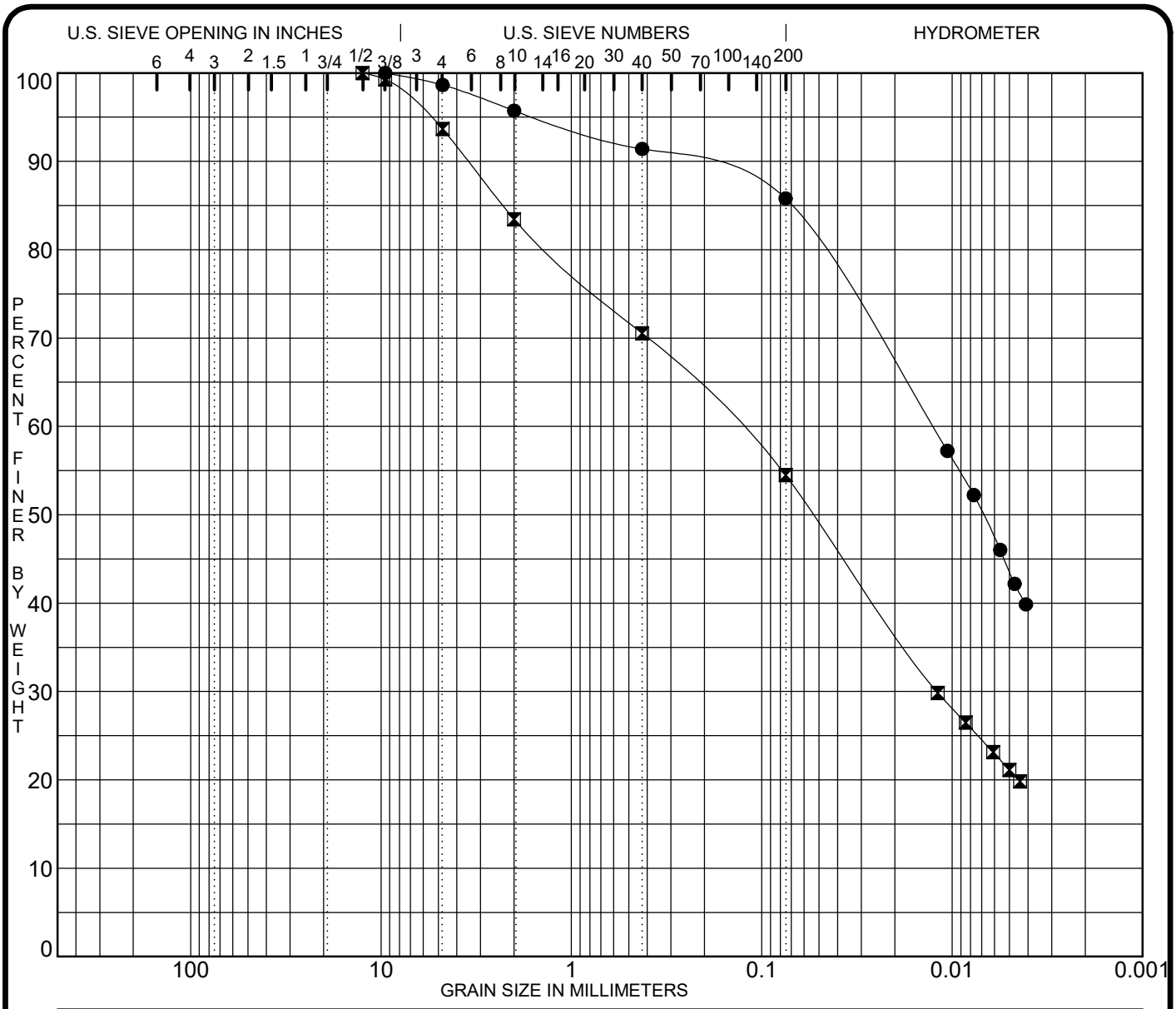
NOTES: Groundwater not encountered during or after drilling completion.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Backfilled with bentonite chips and soil cuttings. Pavement patched with concrete.

000-23 RII USCS BORING LOG - OH DOT.GDT - 11/13/24 13:12 - U:\GI8\PROJECTS\2024\W-24-101.GPJ

APPENDIX IV

LABORATORY TEST RESULTS



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

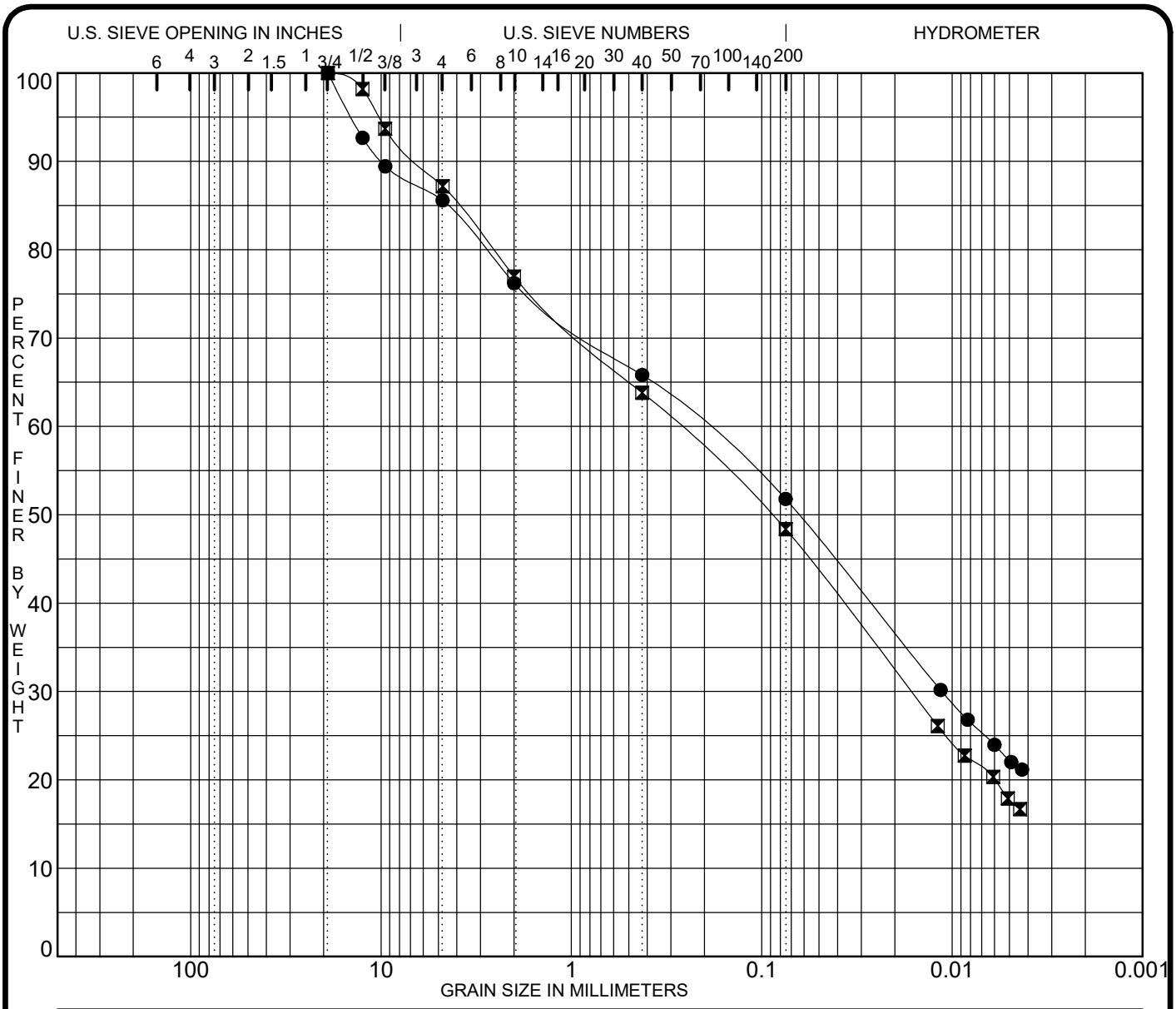
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-01	3.5	LEAN CLAY CL	9	35	16	19		
⊠	B-01	8.5	SANDY LEAN CLAY CL	11	21	13	8		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	B-01	3.5	9.50	0.01			0.0	1.4	2.9	4.3	5.6	42.3	43.5
⊠	B-01	8.5	12.50	0.14	0.012		0.0	6.3	10.2	12.9	16.1	33.4	21.1

PROJECT _____ PROJECT NO. **W-24-101**

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

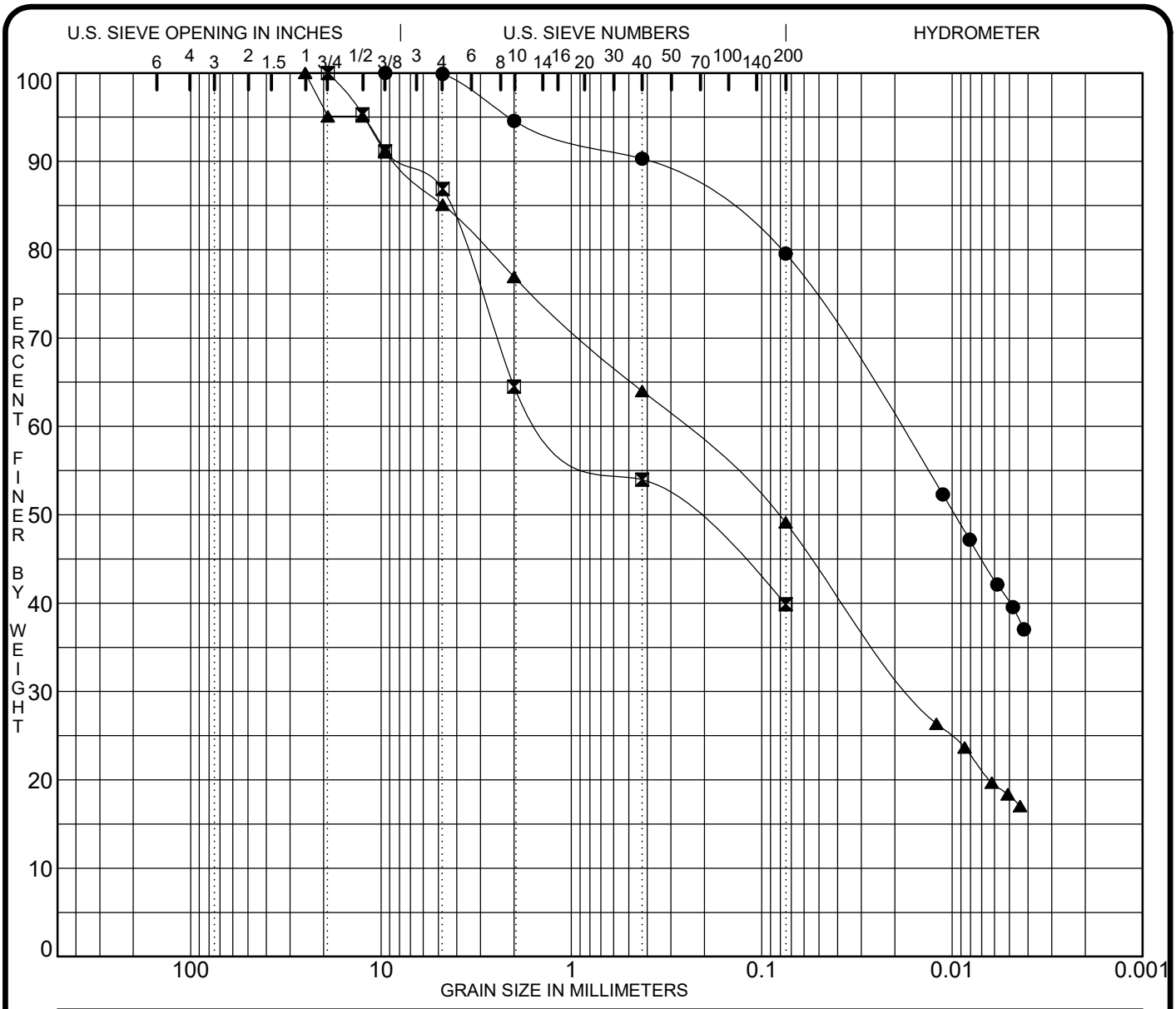
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-02	3.5	SANDY LEAN CLAY CL	7	27	14	13		
⊠	B-02	8.5	SILTY, CLAYEY SAND SC-SM	12	20	13	7		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	B-02	3.5	19.00	0.21	0.011		0.0	14.4	9.4	10.4	14.0	29.6	22.2
⊠	B-02	8.5	19.00	0.28	0.016		0.0	12.8	10.2	13.2	15.4	30.6	17.7

PROJECT _____ PROJECT NO. **W-24-101**

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

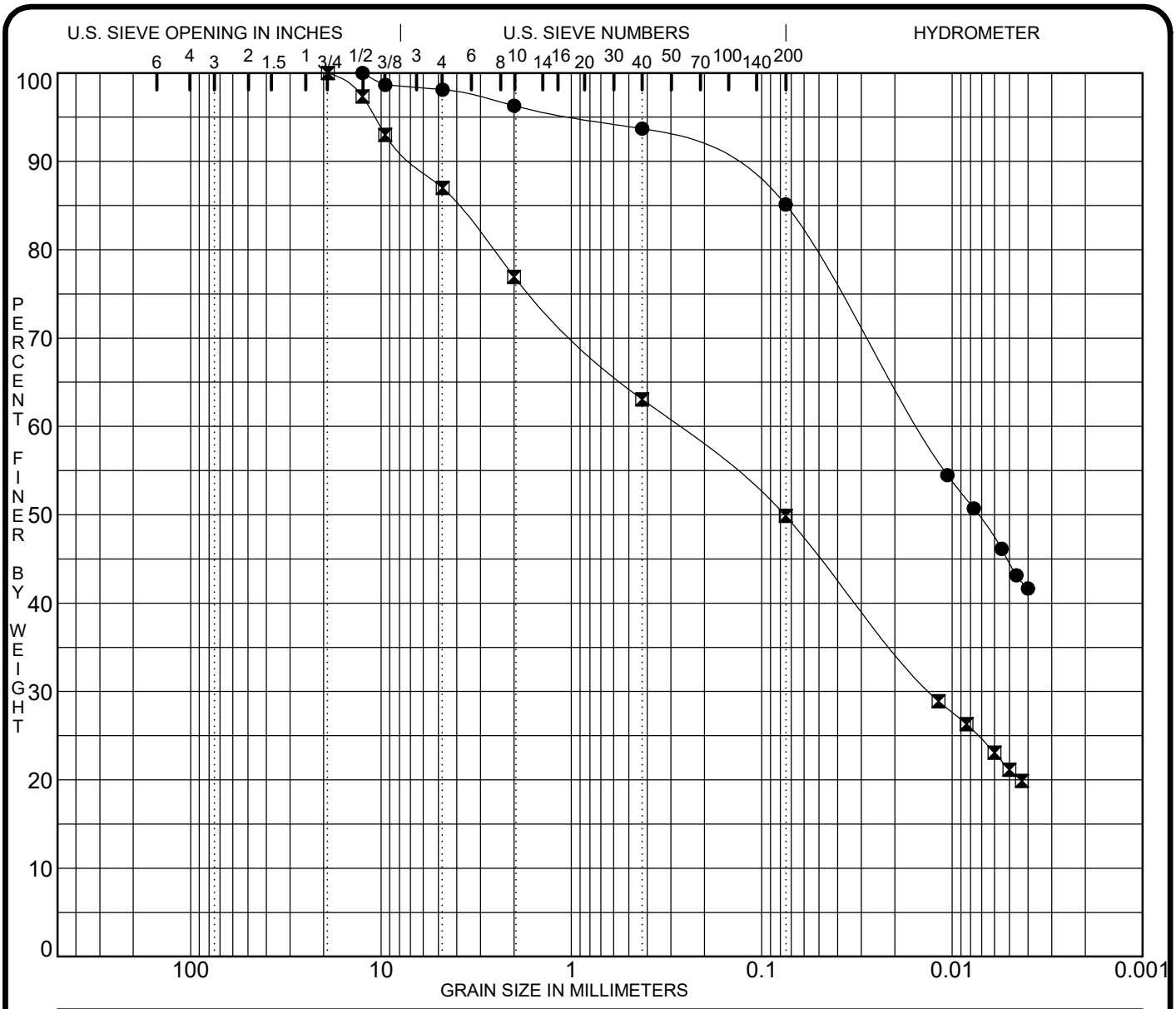
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-03	3.5	FAT CLAY with SAND CH	16	53	19	34		
⊠	B-03	6.5		8					
▲	B-03	8.5	CLAYEY SAND SC	13	22	14	8		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	B-03	3.5	9.50	0.02			0.0	0.1	5.3	4.3	10.7	39.5	40.1
⊠	B-03	6.5	19.00	1.03			0.0	13.1	22.4	10.5	14.1	39.9	
▲	B-03	8.5	25.00	0.27	0.016		4.9	10.0	8.2	12.9	14.9	30.9	18.2

PROJECT _____ PROJECT NO. **W-24-101**

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

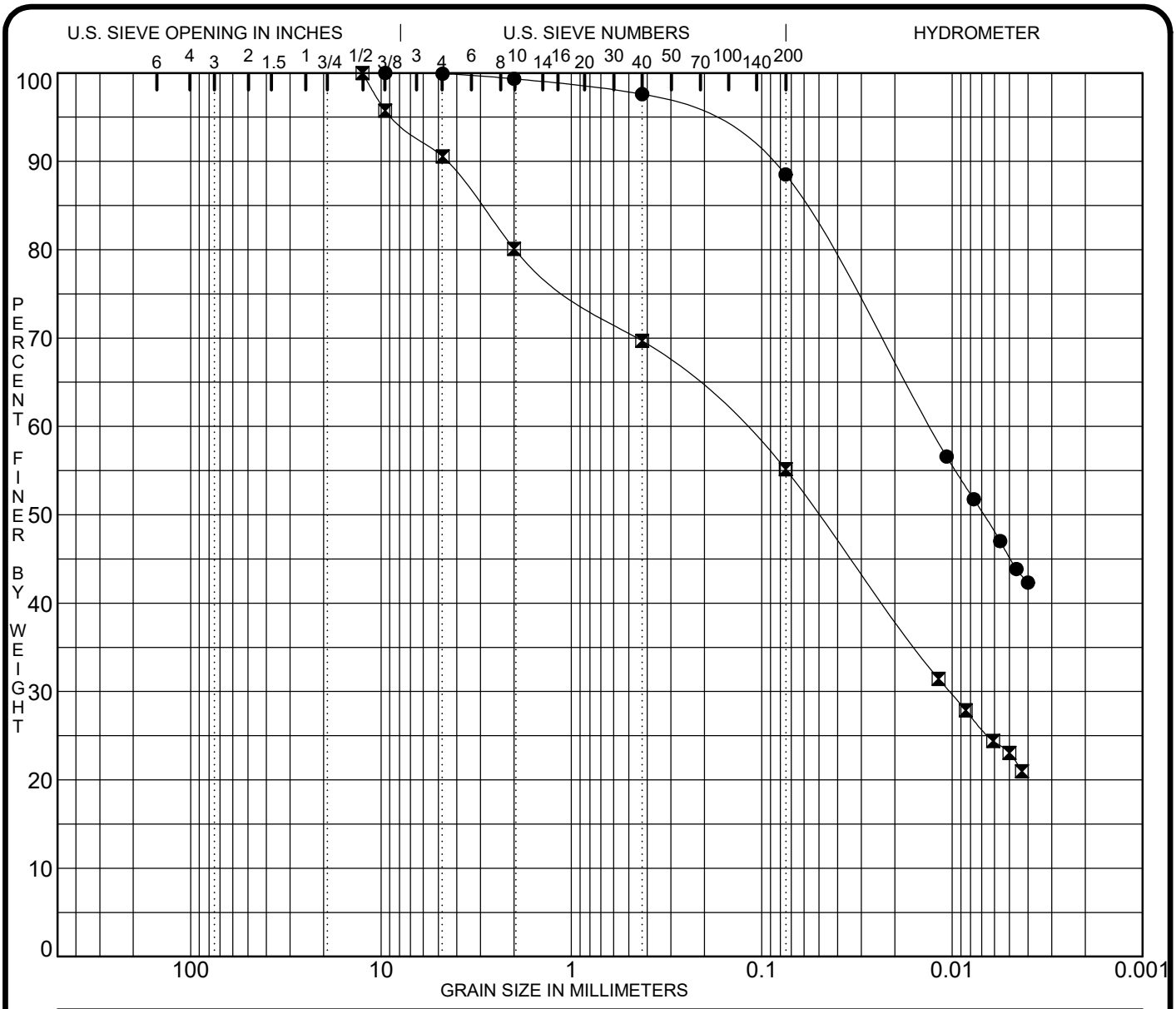
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-04**	**1.0**	**FAT CLAY CH**	**18**	**56**	**17**	**39**		
⊠	**B-04**	**6.0**	**CLAYEY SAND SC**	**12**	**24**	**14**	**10**		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**B-04**	**1.0**	**12.50**	**0.02**			**0.0**	**1.9**	**1.8**	**2.6**	**8.6**	**40.6**	**44.5**
⊠	**B-04**	**6.0**	**19.00**	**0.28**	**0.013**		**0.0**	**13.0**	**10.0**	**13.9**	**13.2**	**28.7**	**21.2**

PROJECT _____ PROJECT NO. **W-24-101**

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

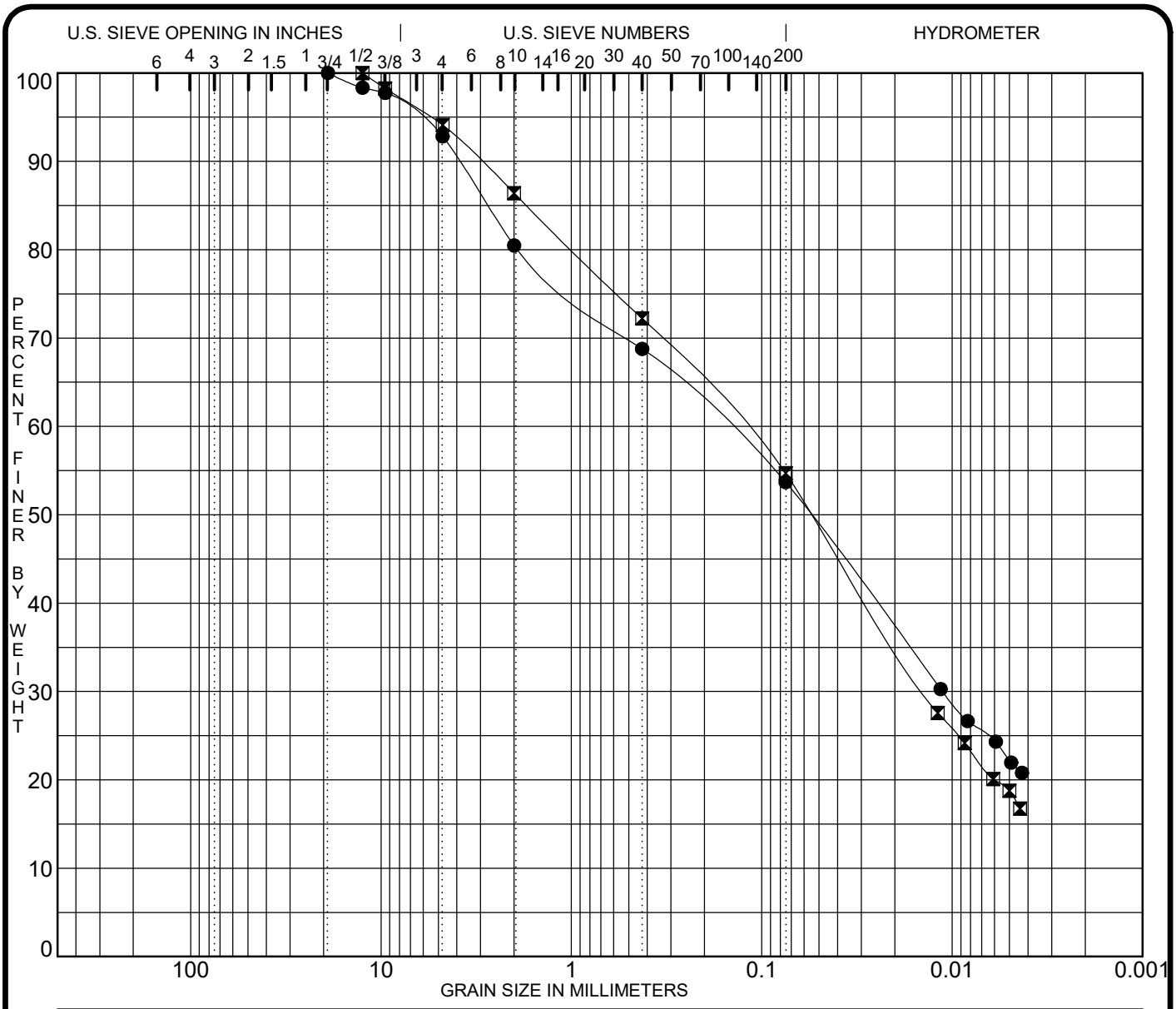
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-05**	**3.5**	**FAT CLAY CH**	**18**	**53**	**16**	**37**		
⊠	**B-05**	**8.5**	**SANDY LEAN CLAY CL**	**10**	**26**	**15**	**11**		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**B-05**	**3.5**	**9.50**	**0.01**			**0.0**	**0.1**	**0.6**	**1.7**	**9.1**	**43.3**	**45.2**
⊠	**B-05**	**8.5**	**12.50**	**0.13**	**0.010**		**0.0**	**9.5**	**10.4**	**10.4**	**14.5**	**32.1**	**23.0**

PROJECT _____ PROJECT NO. **W-24-101**

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

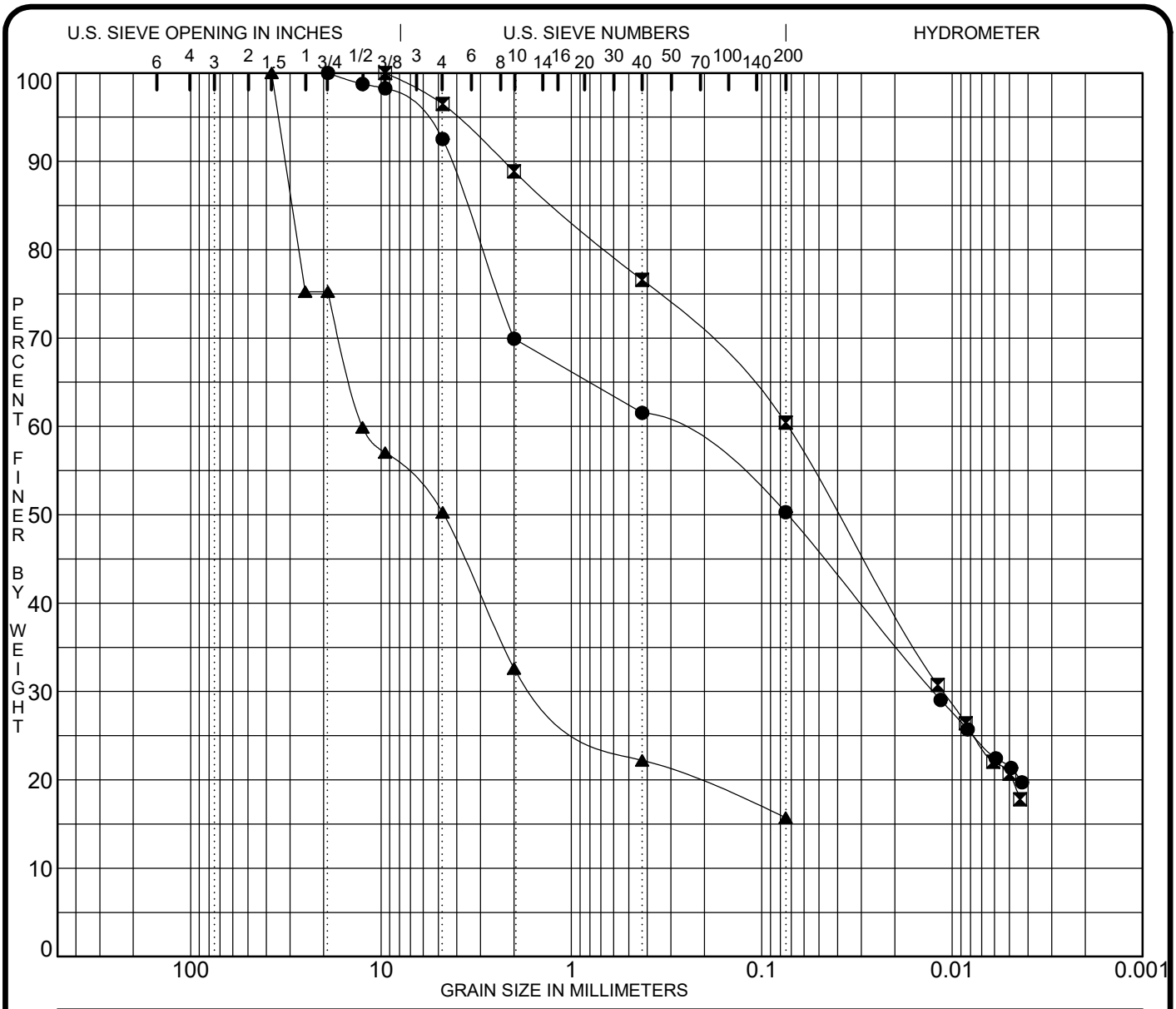
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-06	3.5	SANDY LEAN CLAY CL	10	23	14	9		
⊠	B-06	8.5	SANDY SILTY CLAY CL-ML	12	20	14	6		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	B-06	3.5	19.00	0.15	0.011		0.0	7.2	12.4	11.7	15.1	31.5	22.2
⊠	B-06	8.5	12.50	0.13	0.014		0.0	5.9	7.7	14.2	17.5	35.9	18.8

PROJECT _____ PROJECT NO. **W-24-101**

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

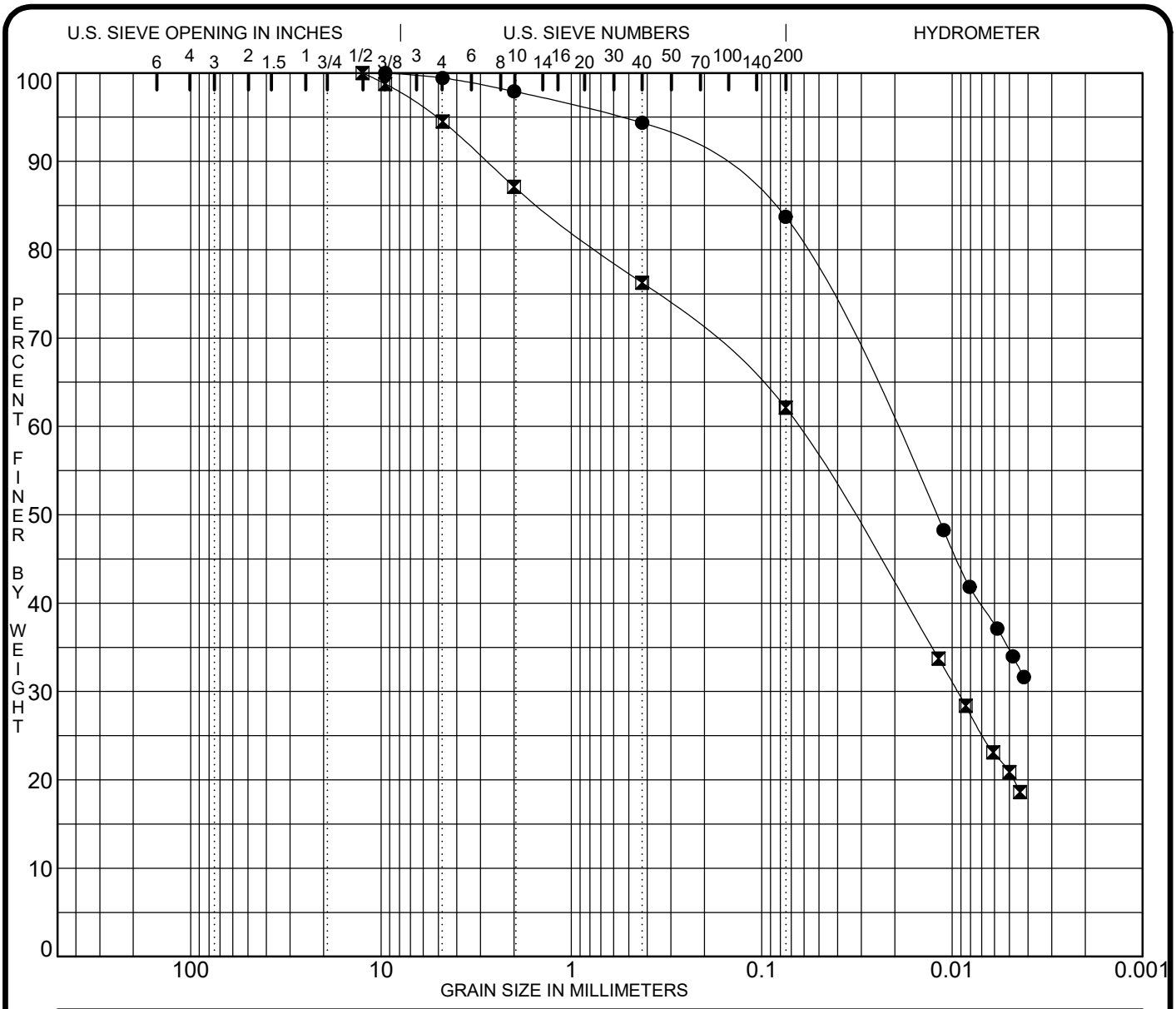
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-07**	**1.0**	**SANDY LEAN CLAY CL**	**23**	**30**	**14**	**16**		
⊠	**B-07**	**3.5**	**SANDY LEAN CLAY CL**	**13**	**21**	**13**	**8**		
▲	**B-07**	**7.0**		**11**					

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**B-07**	**1.0**	**19.00**	**0.34**	**0.013**		**0.0**	**7.5**	**22.6**	**8.4**	**11.2**	**28.8**	**21.5**
⊠	**B-07**	**3.5**	**9.50**	**0.07**	**0.011**		**0.0**	**3.5**	**7.6**	**12.3**	**16.2**	**39.7**	**20.7**
▲	**B-07**	**7.0**	**37.50**	**12.54**	**1.357**		**24.8**	**25.0**	**17.7**	**10.4**	**6.5**	**15.7**	

PROJECT _____ PROJECT NO. **W-24-101**

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

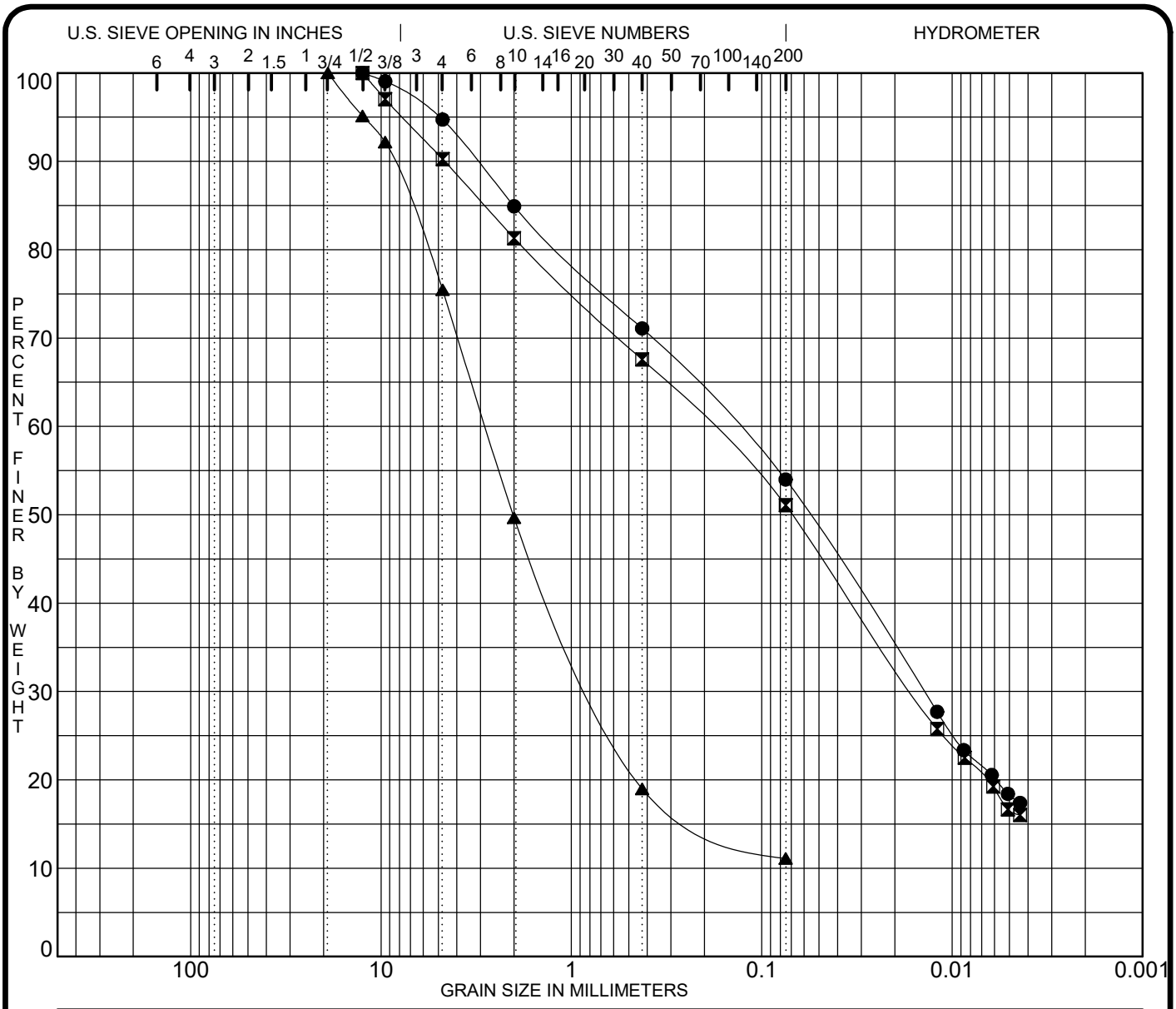
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-08	1.0	LEAN CLAY with SAND CL	21	36	16	20		
⊠	B-08	8.5	SANDY SILTY CLAY CL-ML	13	20	14	6		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	B-08	1.0	9.50	0.02			0.0	0.6	1.5	3.5	10.7	49.1	34.7
⊠	B-08	8.5	12.50	0.07	0.009		0.0	5.5	7.4	10.9	14.1	41.3	20.9

PROJECT _____ PROJECT NO. **W-24-101**

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

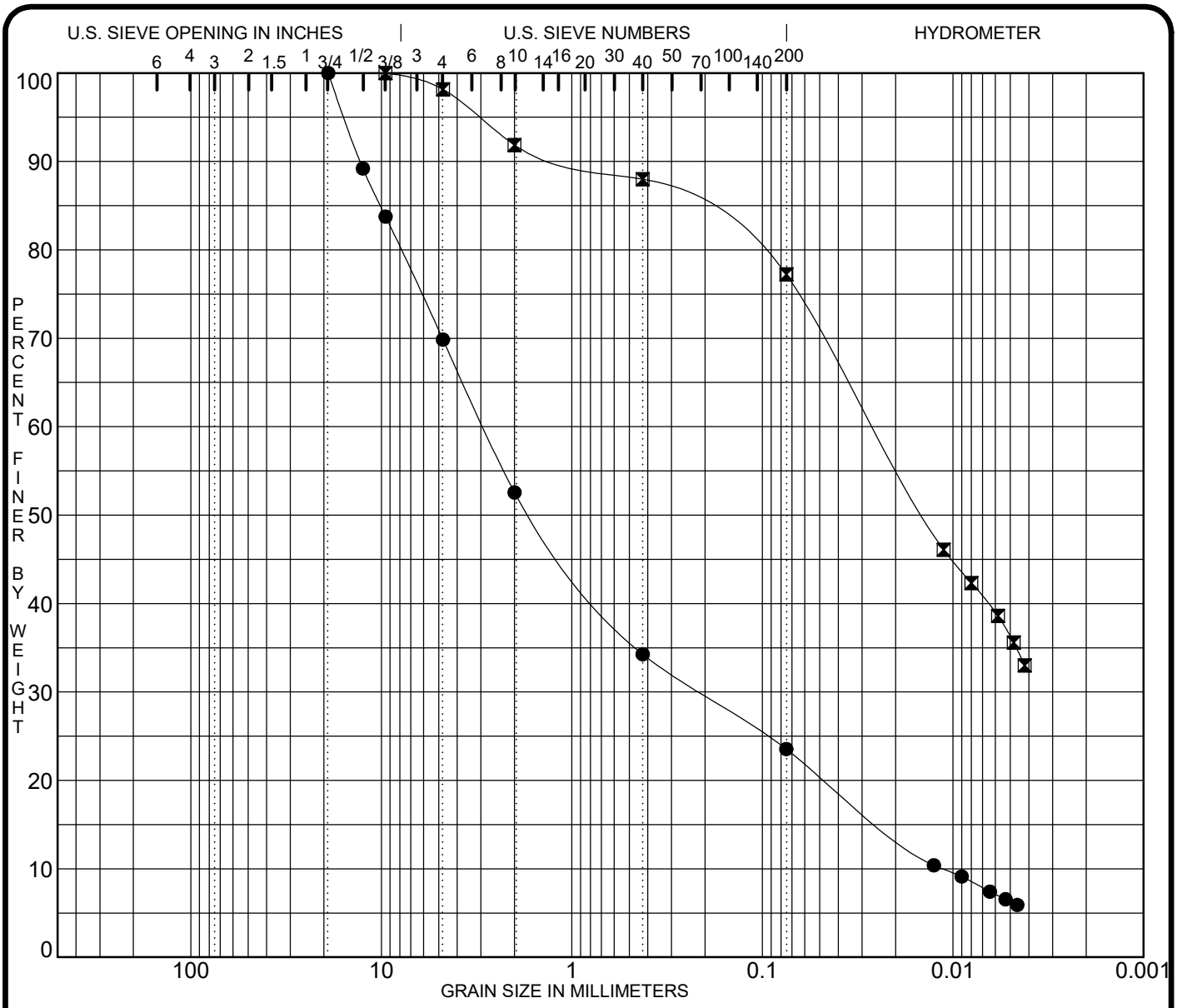
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-09	1.0	SANDY SILTY CLAY CL-ML	9	19	12	7		
⊠	B-09	3.5	SANDY LEAN CLAY CL	14	21	13	8		
▲	B-09	6.0		12				3.30	48.1

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	B-09	1.0	12.50	0.14	0.014		0.0	5.3	9.8	13.8	17.1	35.7	18.3
⊠	B-09	3.5	12.50	0.19	0.016		0.0	9.8	8.9	13.7	16.5	34.5	16.6
▲	B-09	6.0	19.00	2.83	0.741		0.0	24.5	25.8	30.7	7.9	11.1	

PROJECT _____ PROJECT NO. **W-24-101**

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

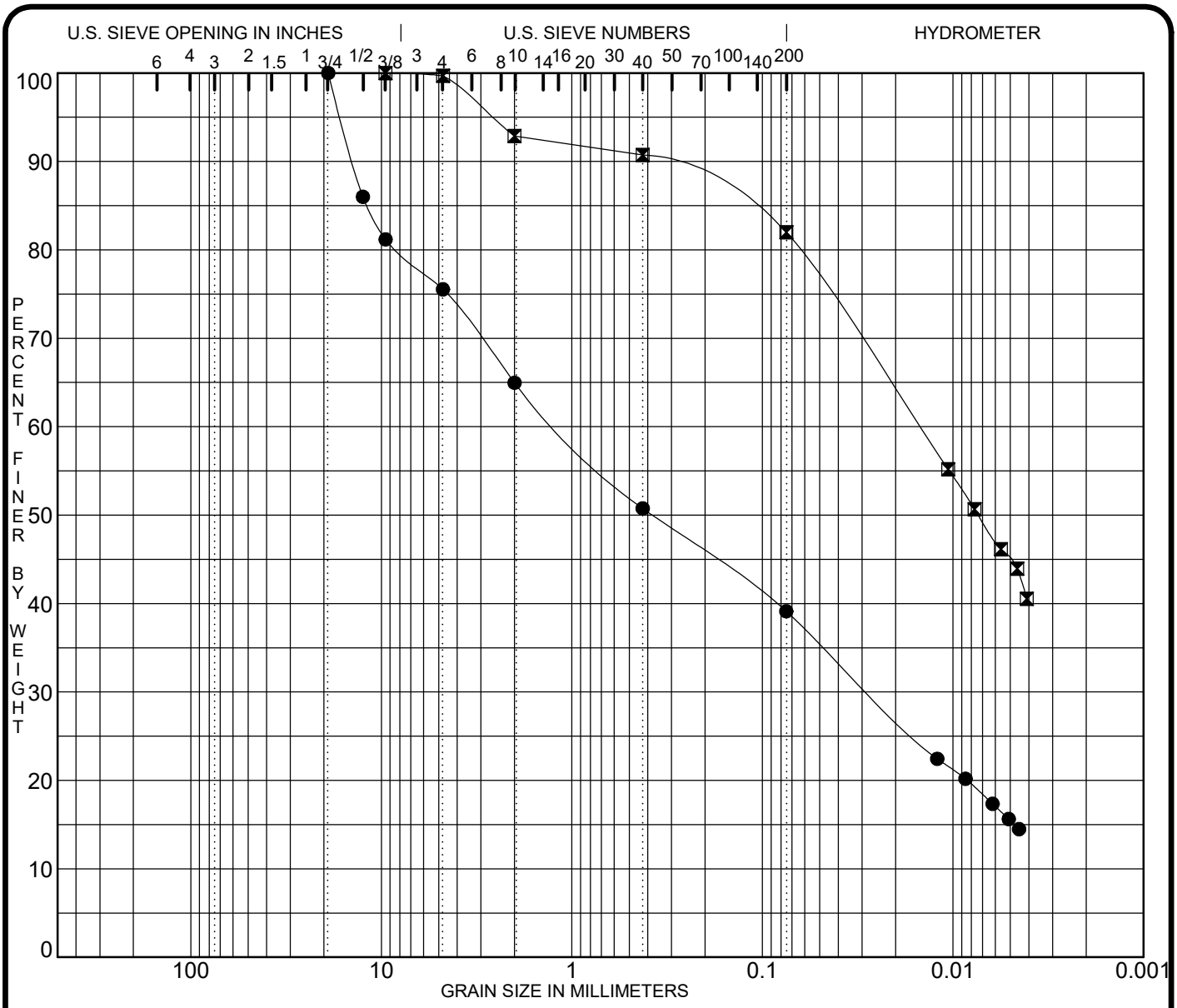
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	P-01	1.0	SILTY SAND with GRAVEL SM	5	18	15	3	1.38	255.6
⊠	P-01	3.5	LEAN CLAY with SAND CL	17	38	15	23		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	P-01	1.0	19.00	2.90	0.213	0.0114	0.0	30.2	17.3	18.3	10.7	17.2	6.3
⊠	P-01	3.5	9.50	0.03			0.0	1.8	6.3	3.9	10.8	41.0	36.2

PROJECT _____ PROJECT NO. **W-24-101**

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

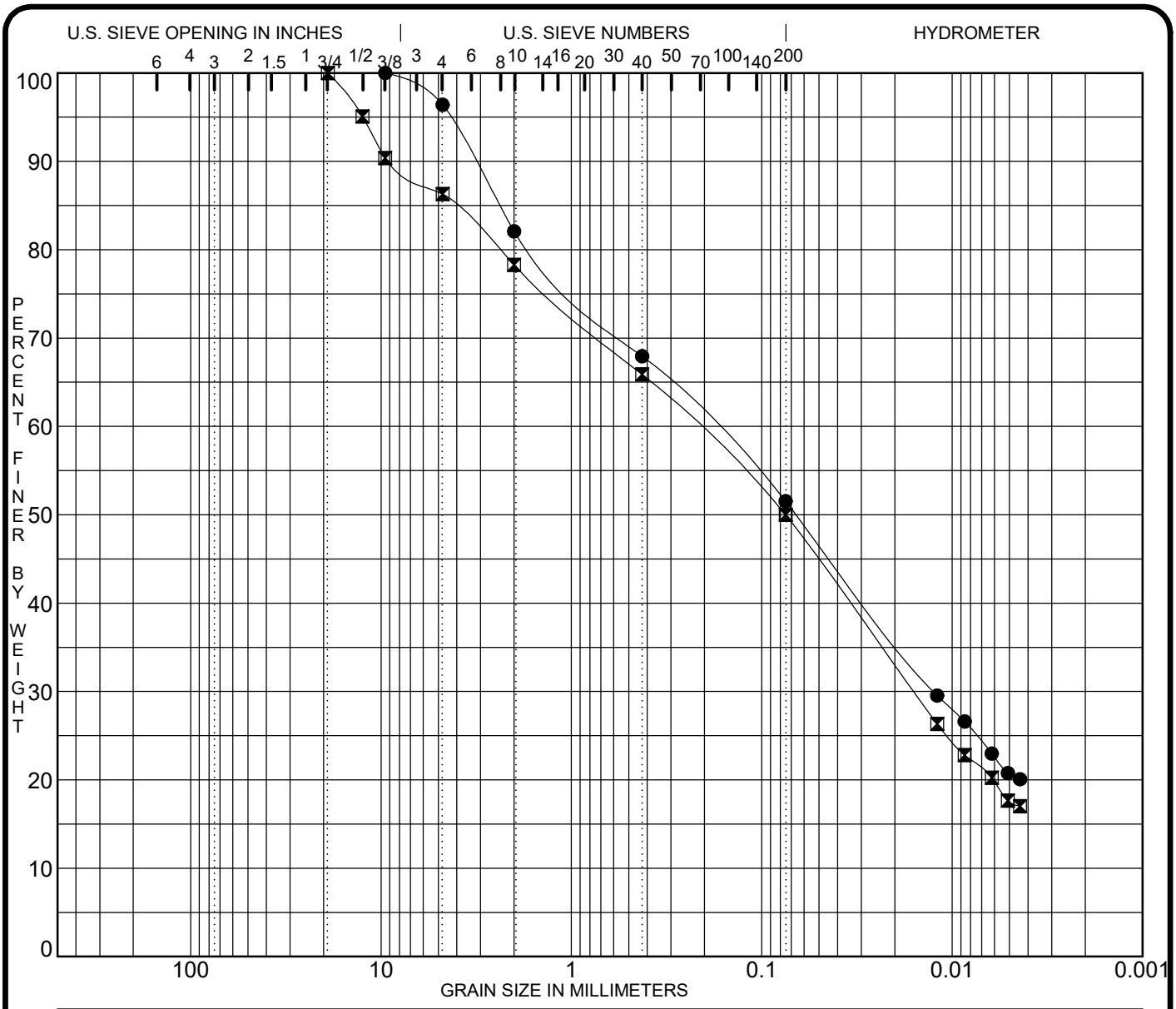
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	P-02	1.0	CLAYEY SAND with GRAVEL SC	13	23	14	9		
⊠	P-02	3.5	FAT CLAY with SAND CH	22	51	17	34		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	P-02	1.0	19.00	1.16	0.028		0.0	24.5	10.6	14.2	11.6	23.7	15.4
⊠	P-02	3.5	9.50	0.02			0.0	0.3	6.8	2.1	8.7	37.1	44.9

PROJECT _____ PROJECT NO. **W-24-101**

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

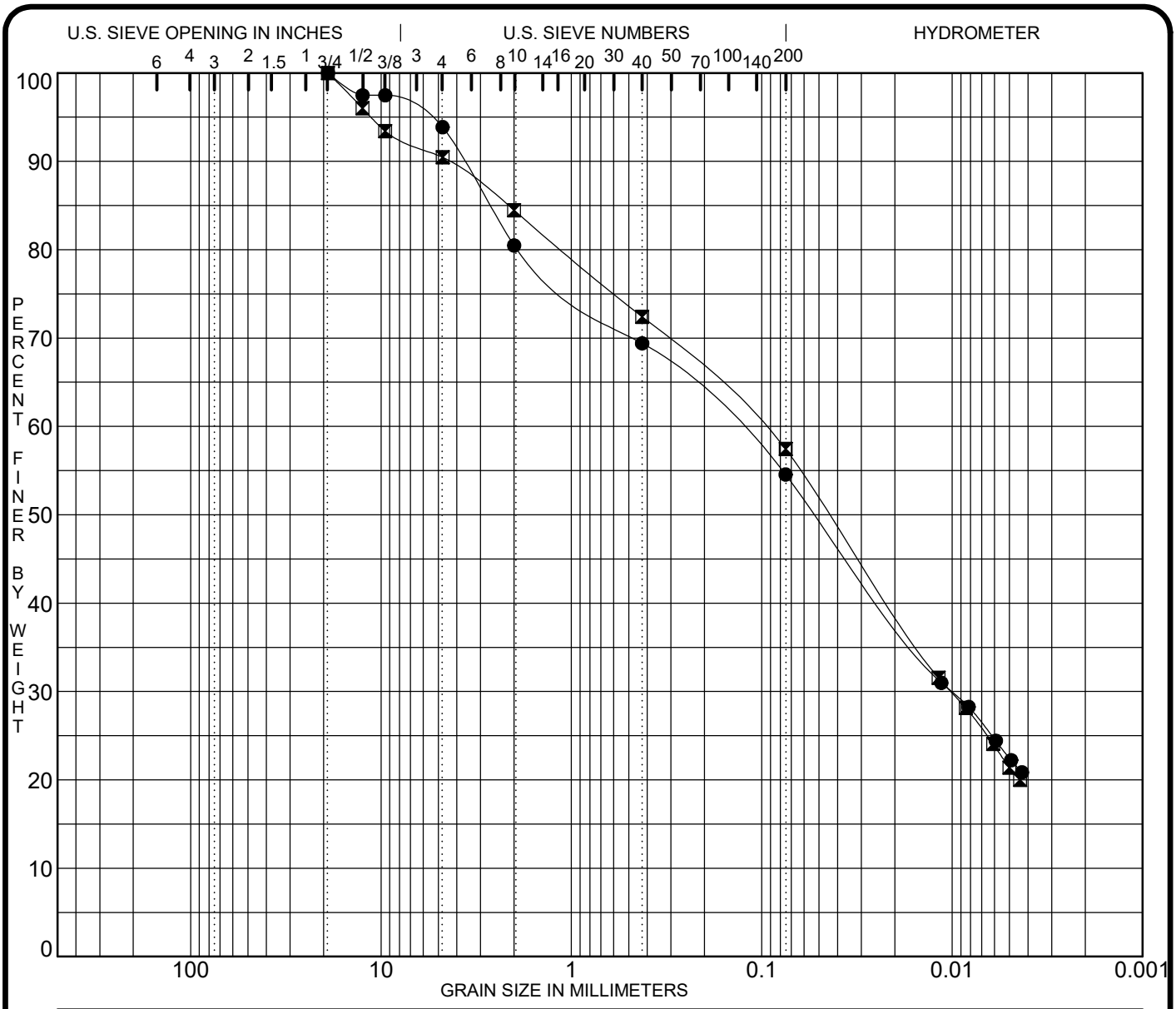
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**P-03**	**1.0**	**SANDY LEAN CLAY CL**	**11**	**21**	**13**	**8**		
⊠	**P-03**	**3.5**	**CLAYEY SAND SC**	**12**	**21**	**13**	**8**		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**P-03**	**1.0**	**9.50**	**0.18**	**0.012**		**0.0**	**3.6**	**14.3**	**14.1**	**16.4**	**30.9**	**20.7**
⊠	**P-03**	**3.5**	**19.00**	**0.22**	**0.016**		**0.0**	**13.7**	**8.0**	**12.4**	**15.9**	**32.4**	**17.6**

PROJECT _____ PROJECT NO. **W-24-101**

GRADATION CURVES

RII



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**P-04**	**1.0**	**SANDY LEAN CLAY CL**	**9**	**22**	**13**	**9**		
⊠	**P-04**	**5.0**	**SANDY LEAN CLAY CL**	**10**	**22**	**13**	**9**		

	Specimen ID	Depth	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**P-04**	**1.0**	**19.00**	**0.14**	**0.010**		**0.0**	**6.1**	**13.4**	**11.1**	**14.8**	**32.1**	**22.5**
⊠	**P-04**	**5.0**	**19.00**	**0.10**	**0.010**		**0.0**	**9.5**	**6.0**	**12.1**	**15.0**	**36.0**	**21.4**

PROJECT _____ PROJECT NO. **W-24-101**

GRADATION CURVES

RII

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

UNCONFINED COMPRESSION

ASTM D2166

PROJECT	ODRC LOCI Auto Garage
JOB No.	W-24-101
BORING	B-3A
STATION / OFFSET	
SAMPLE No. / DEPTH	ST-1 / 9'-9.5'
DATE OF TESTING	11/08/2024
TESTED BY	ML

Soil Description: CL
Soil Classification: Sandy Lean Clay

Physical Characteristics	L.L.	P.L.	P.I.	Gravel%	Sand%	Silt%	Clay%

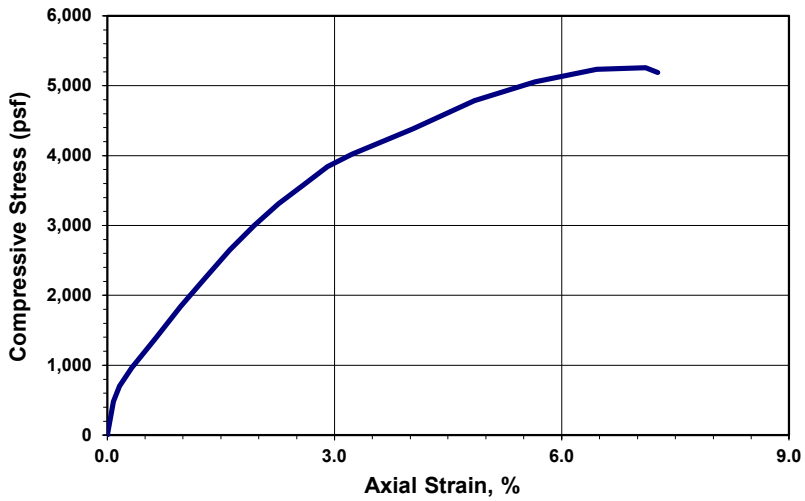
DIAMETER, D_0	2.897	in	73.6	mm	STRAIN RATE	1.50	%/min
AREA, A_0	6.590	in^2	42.5	cm^2	WET SOIL + PAN MASS	1603.4	g
HEIGHT, L_0	6.192	in	157.27	mm	PAN MASS	77.6	g
VOLUME, V_0	40.803	in^3	668.65	cm^3	DRY SOIL + PAN MASS	1463.1	g
MACH. RATE	0.093	in/min			WET DENSITY	142.45	lb/ft^3
WATER CONT.	10.13	%			DRY DENSITY	129.35	lb/ft^3

UNCONFINED COMPRESSION STRESS, q_u	**5,257**	**psf**	2.63	tsf
AXIAL STRAIN @ FAILURE			7.11	%
HAND PENETROMETER			3.25	tsf

Failure Sketch



Unconfined Compression Test



STORMWATER MANAGEMENT DESIGN REPORT

for

London Correctional Institution
1580 OH-56
London, OH
Madison County

Prepared by

P.O. Box 74
Canfield, OH 44406
www.jmwsitedesign.com

July 31, 2025

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SECTION 1

NARRATIVE

Introduction

The Ohio Department of Rehabilitation and Correction plans to build a new auto/bus repair garage at the London Correctional Institution (LOCI). The site is located at 1580 OH-56 in London, Ohio within Madison County. The overall property of LOCI is approximately 475 acres and includes dormitories, access and security roads, a bureau of criminal investigation, a main stockade building and more. The proposed garage will be located on the west side of the property, between the access road and service road.

The repair garage will be used to service the Institution's cars and buses and when needed, it can be used to wash the automobiles as well. The repair garage will be approximately 16,230 square feet and will be able to service two buses and 7 cars at a time. The bus and automobile garages will be separated by a row of administrative offices. A mezzanine will be featured above these offices. It will also feature a parking lot able to accommodate 27 automobiles. Two entrance drives will connect the proposed site to the existing access road on the western side of the site.

Stormwater Management Requirements

The proposed site is located within Madison County and outside of the city of London. In different conditions, Madison County would have jurisdiction over the proposed stormwater management for this project. However, since the site is owned by the Ohio Department of Rehabilitation and Correction (a state agency), the proposed stormwater management will be exempt from Madison County's requirements. This was confirmed by Ken Koppes, Madison County Deputy Engineer, via email confirmation and can be viewed in Section 10 of this report. Even though it was not required, peak flow in proposed conditions is less than existing.

Since the proposed site will require more than 1-acre of disturbance, it must adhere to the National Pollutant Discharge Elimination System (NPDES) requirements. From the Ohio Environmental Protection Agency's General Permit for Stormwater Discharges Section G.2.e.iv, all construction activities must be sized to treat the water quality volume and ensure compliance with Ohio's Water Quality Standards in OAC Chapter 3745-1.

The requirements state that the outlet structure shall not discharge more than the first half of the Water Quality Volume in less than one-third of the minimum drain time. Additionally, the extended detention volume drawdown time must be kept to a minimum of 48 hours.

Existing Conditions

The site is approximately 2 acres of mostly grassed area that features an elevation change of around eight feet. The peak elevations are located on the western portion of the site at the

existing access road. Stormwater runoff flows east towards the existing security road and the main facility. It is currently captured in catch basins near the security road and flows via an underground pipe gravity conveyance system to the northeast portion of the property. There is also a catch basin to the north of the proposed site that captures runoff. The two catch basins come together in the system approximately 1,200 feet to the northeast of our site. Ultimately, the stormwater discharges roughly 3,100 feet to the northeast of the site and into Oak Run, a stream located on the property. Refer to Section 3 of this report for the existing conditions exhibit (ST-1).

The NOAA Precipitation Frequency Data Server was used to determine the rainfall frequencies of the site. Refer to Section 5 to review the rainfall frequency data for each storm.

The soils located on site are classified as Hydrologic Soil Group D. The Web Soil Survey shows that the on-site soils are Kokomo silty clay loam and Crosby-Lewisburg silt loams. See Section 4 for the Web Soil Survey Map.

From the geotechnical report, groundwater was encountered at depths ranging from six feet to thirteen feet in four out of thirteen borings. Existing lean clay and sandy lean clay fill was observed extending to three feet below the existing grade. The natural soils found under the fill was an assortment of lean clays, fat clays, clayey sand, and mixes of sand and gravel. Fat clay and fat clay with sand were found in borings B-3 through B-5 near and within the proposed building footprint. These soils have high plasticity which makes them susceptible to settlement. In proposed areas of pavement or building, the geotechnical report advises over-excavation to a minimum of 3-ft below the foundation bearing elevation followed by backfilling with compacted LSM or granular engineered fill.

Proposed Conditions

The proposed site features over an acre of impervious surface. To comply with water quality volume requirements, a dry extended detention pond with an outlet control structure is proposed. The stormwater will be captured via catch basins which will flow to the proposed pond using an underground pipe gravity conveyance system. The pond outlets to an existing catch basin located to the northeast of the site. Refer to Section 3 of this report for the proposed conditions exhibit (ST-2).

The calculation summary in Section 2 shows that the proposed peak flows of the varying storms are less than their corresponding peak flows in pre-developed conditions.

Watershed Analysis

The proposed stormwater design will divert 1.91-acres of runoff to a different upstream watershed (See exhibits ST-1 and ST-2 in section 3). Ultimately, the runoff will be conveyed to the same Oak Run outlet that serves the entire facility. However, we analyzed topographic and stormwater pipe records to check for potential negative downstream impacts.

We analyzed about 6-acres of topographic data obtained from survey in the vicinity of the proposed project. We also used the county GIS to evaluate topography for the remainder of the approximately 475-acre site. The proposed project will add runoff to an adjacent watershed located west of the site. That watershed is currently about 10-acres in size. However, about 8-acres of that watershed is actively used for agriculture. It is likely that runoff from those 8-acres is managed using underdrains and not conveyed into the pipe system that will serve the proposed site. Therefore, we estimate that the proposed project will increase the runoff area of the adjacent watershed to about 4-acres; a reasonable amount of area.

We used record drawings and the survey to analyze the impacts to the underground stormwater sewers. In our opinion, there isn't another reasonable option for conveying the site's runoff because there are no other downstream storm sewer runs to access. About 300-ft north of our site, the 12-inch diameter pipe increases to 24-inches. The record drawings show that the storm sewer eventually increases to 42-inches in diameter before discharging to Oak Run.

Finally, we analyzed the overland flow path if the downstream pipe and/or the proposed pond were to back up. The GIS contours and record drawings show a clear grassed path sloped at about 1% to the northeast. There is a catch basin located about 550-ft away from the proposed pond that would receive that runoff. The survey shows that the rim elevation of that catch basin is 1075.65-ft. The record plans show that there are no structures within the overflow path. The GIS contours show that the nearest buildings are at about a finished floor elevation of 1078.00-ft. Therefore, it is unlikely that nearby buildings would be impacted if the primary stormwater routing ever backed up.

Overflow Spillway

An emergency spillway was provided for the proposed pond. The top of the pond is located at elevation 1079.86-feet, and the spillway elevation is at 1078.82-feet which is 1.04-ft below. This provides over one foot of freeboard for the pond. Refer to Section 9 for the peak flows and additional modeling of the emergency spillway.

Water Quality Volume Calculations

In accordance with Section 2 of the NPDES Permit, water the quality volume was calculated, and the extended detention volume (EDv) drawdown time was met using a dry extended detention basin. To view the EDv drawdown graphs, refer to Section 6 of this report.

The EDv for the Proposed Detention Pond was calculated as 3,517 cubic feet. To meet the minimum drawdown time of 48 hours for a dry basin, a water quality volume orifice size of 0.80 inches was used which resulted in an EDv drawdown time of 59 hours. The secondary outlet invert elevation is at 1077.51, providing a water quality treatment volume of 3,838 cubic feet, exceeding the minimum of 3,517 cubic feet.

SECTION 2

STORMWATER CALCULATION SUMMARY

Curve Number for Pre-developed and Post-developed Conditions

	Cover Description	Soil name	Hydrologic Soil Group	CN	Area (AC)	CN *A	Weighted CN	Total Area (AC)
Pre-Developed Conditions	Grass Cover - Greater than 75%	Ko, Kokomo silty clay loam and CsB, Crosby Lewisburg silt loams	D	80	1.976	158.1	81	2.09
	Asphalt Pavement	-	-	98	0.116	11.4		
Post-Developed Conditions	Asphalt Pavement and Proposed Bulding	-	-	98	1.088	106.6	90	1.91
	Grass Cover - Greater than 75%	Ko, Kokomo silty clay loam and CsB, Crosby Lewisburg silt loams	D	80	0.821	65.7		
Post-Developed Conditions: Off-Site Drainage	Grass Cover - Greater than 75%	Ko, Kokomo silty clay loam and CsB, Crosby Lewisburg silt loams	D	80	0.184	14.722	80	0.18

Time of Concentration for Pre-developed and Post-developed Conditions

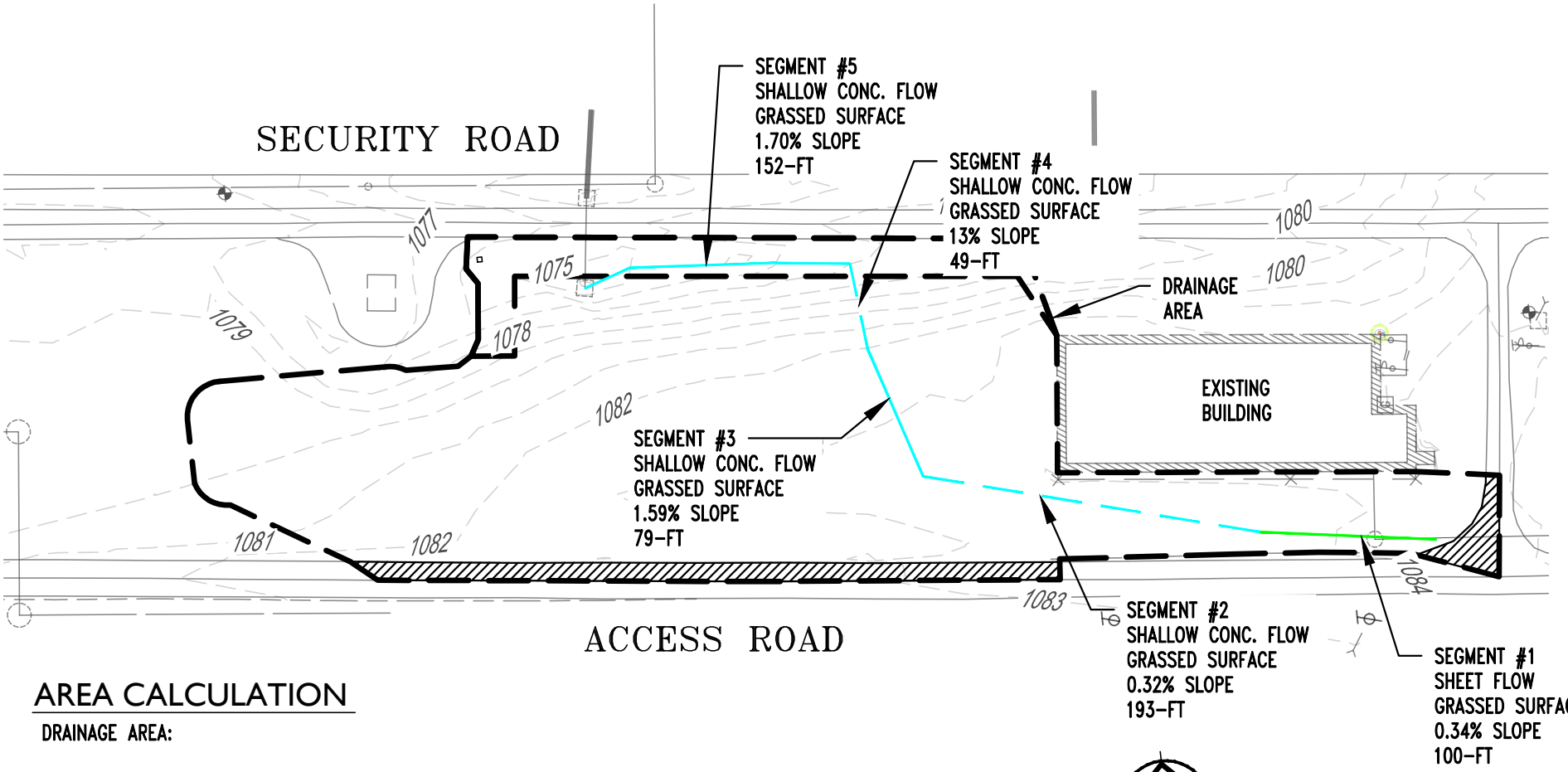
	Segment #	Flow Type	Surface Cover	Manning's n	Length (ft.)	Slope (%)	Velocity (fps)	Tc (min.)	Total Length (ft.)	Total Tc (min)
Pre-Developed Conditions	1	Sheet	Grass	0.41	100	0.34	0.03	49.0	573	55.0
	2	Shallow Conc. Flow	Grassed Waterway	-	193	0.32	0.85	3.8		
	3	Shallow Conc. Flow	Grassed Waterway	-	79	1.59	1.89	0.7		
	4	Shallow Conc. Flow	Grassed Waterway	-	49	13.00	5.41	0.2		
	5	Shallow Conc. Flow	Grassed Waterway	-	152	1.70	1.96	1.3		
Post-Developed Conditions	1	Sheet	Grass	0.41	100	0.34	0.03	49.0	663	53.7
	2	Shallow Conc. Flow	Grassed Waterway	-	133	0.33	0.86	2.6		
	3	Shallow Conc. Flow	Paved Surface	-	76	1.50	2.49	0.5		
	4	Pipe Flow	-	0.013	42	1.05	4.65	0.2		
	5	Pipe Flow	-	0.013	189	0.75	3.93	0.8		
	6	Pipe Flow	-	0.013	123	0.50	3.21	0.6		
Post-Developed Conditions: Off-Site Drainage	1	Sheet	Grass	0.41	19	30.00	0.15	2.2	19	2.2

Peak Flow Summary for Pre-developed and Post-developed Conditions

Rain Event (Years)	P (in.)	Q_{pre} Total (CF)	Q_{post} (CF)	Existing Peak Discharge	Proposed Peak Discharge
				q_{pre} (cfs)	q_{post} (cfs)
1	2.21	5,529	8,712	0.82	0.31
2	2.64	7,789	11,326	1.19	0.72
5	3.23	11,158	15,027	1.74	1.36
10	3.71	14,065	18,105	2.22	1.79
25	4.36	18,174	22,335	2.89	2.27
50	4.89	21,635	25,823	3.44	2.61
100	5.43	25,240	29,402	4.02	3.09

SECTION 3

TIME OF CONCENTRATION EXHIBITS



AREA CALCULATION

DRAINAGE AREA:

5,068 SF TAKEN AS IMPERVIOUS PAVEMENT; CN: 98

86,076 SF TAKEN AS GRASSED SURFACE, HYDROLOGIC GROUP D; CN: 80

TOTAL: 91,144 SF (2.09 ACRES); CN: 81

TOTAL TIME OF CONCENTRATION

TOC: 55.0 MIN

LEGEND:

EXISTING IMPERVIOUS AREA

SCALE: 1:90

Existing Conditions Exhibit

LoCI Auto Repair Garage

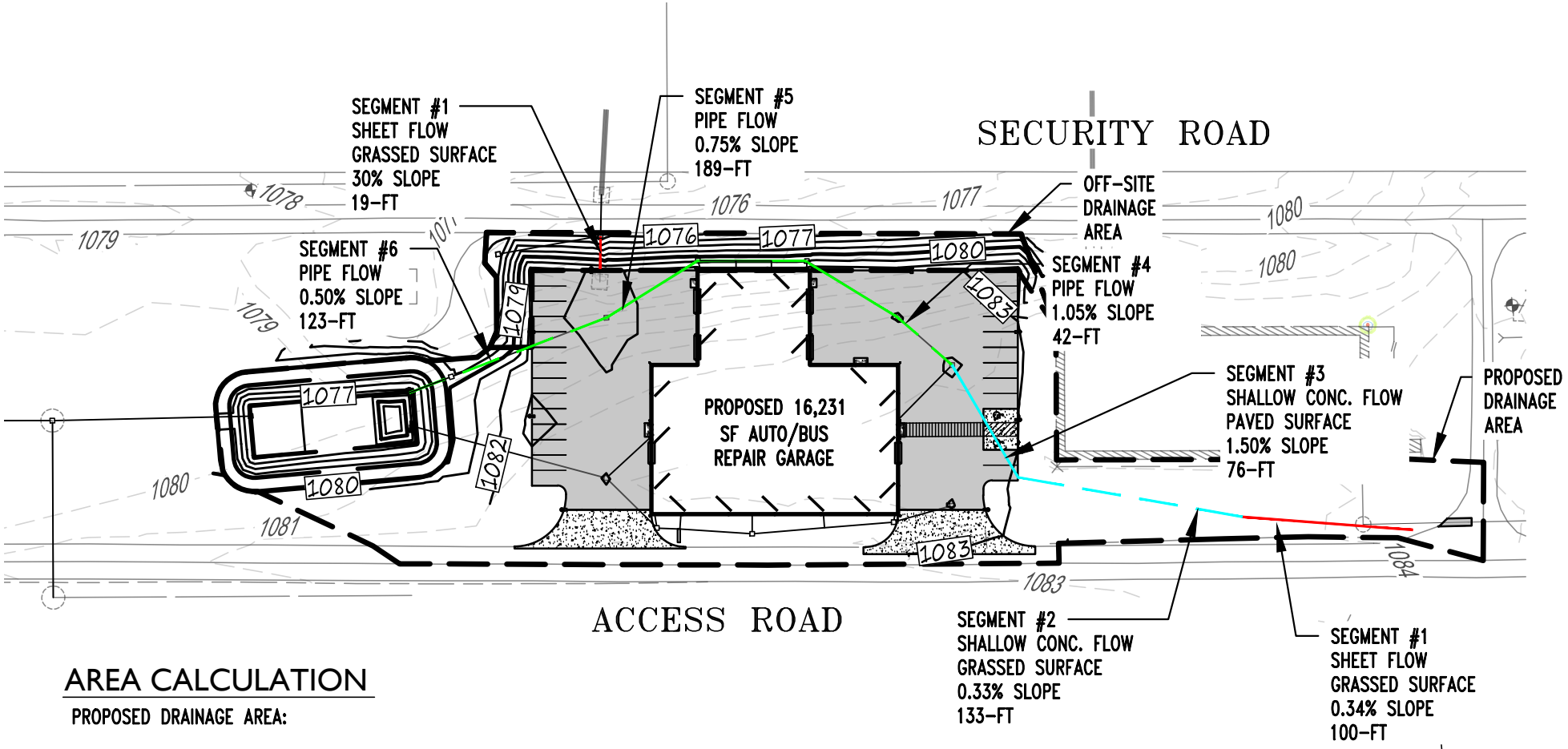
1580 OH-56
London, OH 43140

COUNTY OF
Madison

SCALE: AS NOTED	DATE: ---
PROJECT NO.: N24019	CURRENT REV: ---
DRAWN BY: ---	SHEET NO.: ST-1
CHECKED BY: ---	

JMW SITE DESIGN
P.O. Box 74
Canfield, OH 44406
330-422-8603
jmwsitedesign.com

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7/16/2025



AREA CALCULATION

PROPOSED DRAINAGE AREA:

47,377 SF TAKEN AS IMPERVIOUS SURFACE; CN: 98

35,751 SF TAKEN AS GRASSED SURFACE, HYDROLOGIC GROUP D; CN: 80

GROUP D; CN: 80

TOTAL: 83,128 SF (1.91 ACRES); CN: 90

OFF-SITE DRAINAGE AREA:

8,016 SF TAKEN AS GRASSED SURFACE, HYDROLOGIC GROUP D; CN: 80

TOTAL TIME OF CONCENTRATION

PROPOSED DRAINAGE AREA TOC: 53.7 MIN

PROPOSED OFF-SITE DRAINAGE AREA TOC: 2.2 MIN

SCALE: 1:90

Proposed Conditions Exhibit

LoCI Auto Repair Garage

1580 OH-56
London, OH 43140

COUNTY OF
Madison

SCALE: AS NOTED	DATE: ---
PROJECT NO.: N24019	CURRENT REV: ---
DRAWN BY: ---	SHEET NO.: ST-2
CHECKED BY: ---	

JMW SITE DESIGN
P.O. Box 74
Canfield, OH 44406
330-422-8603
jmwsitedesign.com

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7/16/2025

SECTION 4

USGS SOILS MAP



Map Scale: 1:3,070 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Madison County, Ohio
Survey Area Data: Version 23, Aug 28, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 21, 2023—Aug 8, 2023

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CsB	Crosby-Lewisburg silt loams, 2 to 6 percent slopes	31.2	67.7%
Ko	Kokomo silty clay loam, 0 to 2 percent slopes	14.8	32.3%
Totals for Area of Interest		**46.0**	**100.0%**

SECTION 5

NOAA RAINFALL DATA

NOAA Atlas 14, Volume 2, Version 3
Location name: London, Ohio, USA*
Latitude: 39.9924°, Longitude: -83.5358°
Elevation: 1157 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.356 (0.321-0.395)	0.424 (0.383-0.470)	0.506 (0.457-0.560)	0.570 (0.514-0.629)	0.652 (0.585-0.719)	0.717 (0.640-0.790)	0.779 (0.692-0.857)	0.844 (0.745-0.928)	0.930 (0.815-1.02)	0.994 (0.865-1.09)
10-min	0.553 (0.499-0.614)	0.662 (0.598-0.734)	0.786 (0.710-0.870)	0.880 (0.793-0.972)	0.998 (0.895-1.10)	1.09 (0.970-1.20)	1.17 (1.04-1.29)	1.26 (1.11-1.39)	1.37 (1.20-1.50)	1.45 (1.26-1.59)
15-min	0.678 (0.612-0.752)	0.809 (0.731-0.897)	0.965 (0.871-1.07)	1.08 (0.976-1.20)	1.23 (1.10-1.36)	1.34 (1.20-1.48)	1.46 (1.29-1.60)	1.57 (1.38-1.72)	1.71 (1.50-1.88)	1.81 (1.57-1.99)
30-min	0.898 (0.810-0.995)	1.08 (0.979-1.20)	1.32 (1.19-1.46)	1.50 (1.36-1.66)	1.74 (1.56-1.92)	1.92 (1.72-2.12)	2.10 (1.87-2.31)	2.29 (2.02-2.52)	2.53 (2.22-2.78)	2.71 (2.36-2.98)
60-min	1.10 (0.989-1.22)	1.33 (1.20-1.47)	1.66 (1.50-1.84)	1.91 (1.72-2.11)	2.26 (2.02-2.49)	2.53 (2.26-2.79)	2.81 (2.50-3.09)	3.10 (2.74-3.41)	3.50 (3.06-3.85)	3.81 (3.31-4.19)
2-hr	1.28 (1.16-1.41)	1.55 (1.40-1.71)	1.93 (1.74-2.12)	2.23 (2.01-2.45)	2.64 (2.37-2.90)	2.97 (2.65-3.25)	3.31 (2.94-3.62)	3.66 (3.23-4.00)	4.14 (3.63-4.52)	4.54 (3.94-4.96)
3-hr	1.35 (1.23-1.48)	1.63 (1.49-1.79)	2.03 (1.85-2.22)	2.35 (2.13-2.56)	2.79 (2.52-3.04)	3.14 (2.83-3.42)	3.52 (3.14-3.82)	3.90 (3.47-4.23)	4.44 (3.91-4.82)	4.86 (4.24-5.28)
6-hr	1.60 (1.46-1.76)	1.93 (1.76-2.12)	2.39 (2.17-2.62)	2.77 (2.51-3.03)	3.30 (2.97-3.60)	3.74 (3.35-4.07)	4.20 (3.74-4.56)	4.69 (4.15-5.08)	5.38 (4.70-5.83)	5.93 (5.13-6.43)
12-hr	1.87 (1.69-2.08)	2.24 (2.03-2.49)	2.77 (2.50-3.07)	3.20 (2.88-3.54)	3.81 (3.41-4.19)	4.31 (3.84-4.73)	4.84 (4.28-5.30)	5.40 (4.75-5.91)	6.19 (5.37-6.76)	6.82 (5.86-7.47)
24-hr	2.21 (2.06-2.37)	2.64 (2.46-2.84)	3.23 (3.01-3.48)	3.71 (3.45-3.98)	4.36 (4.04-4.68)	4.89 (4.51-5.24)	5.43 (4.99-5.82)	5.98 (5.48-6.41)	6.75 (6.14-7.24)	7.35 (6.65-7.90)
2-day	2.56 (2.40-2.74)	3.06 (2.87-3.28)	3.73 (3.49-3.99)	4.26 (3.98-4.55)	4.98 (4.64-5.32)	5.56 (5.17-5.94)	6.15 (5.69-6.57)	6.76 (6.22-7.22)	7.58 (6.94-8.12)	8.22 (7.48-8.83)
3-day	2.75 (2.58-2.94)	3.28 (3.08-3.51)	3.99 (3.74-4.26)	4.54 (4.25-4.85)	5.30 (4.94-5.65)	5.90 (5.49-6.29)	6.51 (6.04-6.95)	7.14 (6.59-7.62)	7.99 (7.33-8.55)	8.65 (7.88-9.28)
4-day	2.94 (2.76-3.14)	3.51 (3.29-3.74)	4.24 (3.98-4.53)	4.82 (4.52-5.14)	5.61 (5.24-5.98)	6.24 (5.81-6.64)	6.88 (6.38-7.32)	7.52 (6.96-8.02)	8.40 (7.72-8.97)	9.08 (8.29-9.72)
7-day	3.48 (3.27-3.72)	4.14 (3.89-4.42)	4.99 (4.69-5.33)	5.68 (5.32-6.05)	6.61 (6.18-7.04)	7.36 (6.86-7.84)	8.12 (7.54-8.66)	8.90 (8.23-9.51)	9.98 (9.15-10.7)	10.8 (9.86-11.6)
10-day	3.97 (3.75-4.21)	4.71 (4.44-5.00)	5.63 (5.31-5.98)	6.37 (6.00-6.76)	7.38 (6.93-7.83)	8.18 (7.66-8.67)	8.99 (8.38-9.54)	9.81 (9.11-10.4)	10.9 (10.1-11.6)	11.8 (10.8-12.6)
20-day	5.48 (5.20-5.79)	6.47 (6.14-6.84)	7.62 (7.22-8.04)	8.52 (8.06-8.98)	9.71 (9.17-10.2)	10.6 (10.0-11.2)	11.5 (10.8-12.2)	12.4 (11.7-13.1)	13.6 (12.7-14.4)	14.5 (13.4-15.4)
30-day	6.84 (6.49-7.20)	8.05 (7.64-8.47)	9.35 (8.88-9.84)	10.3 (9.82-10.9)	11.7 (11.0-12.3)	12.6 (11.9-13.3)	13.6 (12.8-14.3)	14.5 (13.7-15.3)	15.7 (14.7-16.6)	16.6 (15.5-17.5)
45-day	8.69 (8.26-9.12)	10.2 (9.71-10.7)	11.7 (11.2-12.3)	12.9 (12.3-13.5)	14.4 (13.6-15.1)	15.5 (14.7-16.2)	16.5 (15.6-17.3)	17.5 (16.5-18.4)	18.7 (17.6-19.7)	19.6 (18.4-20.7)
60-day	10.5 (9.99-11.0)	12.3 (11.7-12.9)	14.1 (13.4-14.8)	15.4 (14.6-16.2)	17.1 (16.2-18.0)	18.4 (17.4-19.3)	19.6 (18.5-20.6)	20.7 (19.6-21.8)	22.1 (20.8-23.3)	23.2 (21.7-24.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

SECTION 6

WATER QUALITY VOLUME CALCULATIONS

Project and Watershed Information; WQv Calculation

version 3.2 2020-07-07

Project Details

Project Name:	LOCI
Project Location:	1580 OH-56
	London, OH 43140
Project Latitude:	39.904
Project Longitude:	-83.487
NPDES Permit Applicant:	
Submitted by:	JMW Site Design, LLC
Date:	7/31/2025

Subwatershed Details

Subwatershed ID/Label:

Subwatershed Drainage Area, A_{total} =	**1.91**	**acres**	**=**	**83,200**	**ft^2**
Subwatershed Impervious Area, A_{imp} =	**1.09**	**acres**	**=**	**47,480**	**ft^2**
Imperviousness fraction, i =	**0.57**		**=**	**57**	**%**
Volumetric Runoff Coefficient, Rv =	**0.56**				
Water Quality Volume, WQv =	**3,517**	**ft^3**	**=**	**0.081**	**ac-ft**

Dry Extended Detention Basin WQv Compliance Tool

version 3.2 2020-07-07

Project Summary

Project Name: LOCI
Subwatershed ID/Label:
Submitted by: JMW Site Design, LLC
Date: 7/31/2025

Subwatershed Drainage Area, A_{total} =	1.91	acres	=	83,200	ft2
Subwatershed Impervious Area, A_{imp} =	1.09	acres	=	47,480	ft2
Imperviousness fraction, i =	0.57			57	%
Water Quality Volume, WQv =	3,517	ft^3	=	0.08	ac-ft

Step 1 - Soil Suitability

Soil Series: Crosby-Lewisburg HSG: D

Step 2 - Dry ED Basin Volume Requirements

Extended Detention Volume, EDv =	3517	ft^3
Minimum Sediment Storage Volume, $V_{sediment}$ =	703	ft^3
Minimum Forebay Volume, $V_{forebay}$ =	352	ft^3
Minimum Permanent Micropool Volume, $V_{micropool}$ =	352	ft^3

Step 3 - Basin Stage-Storage Relationship

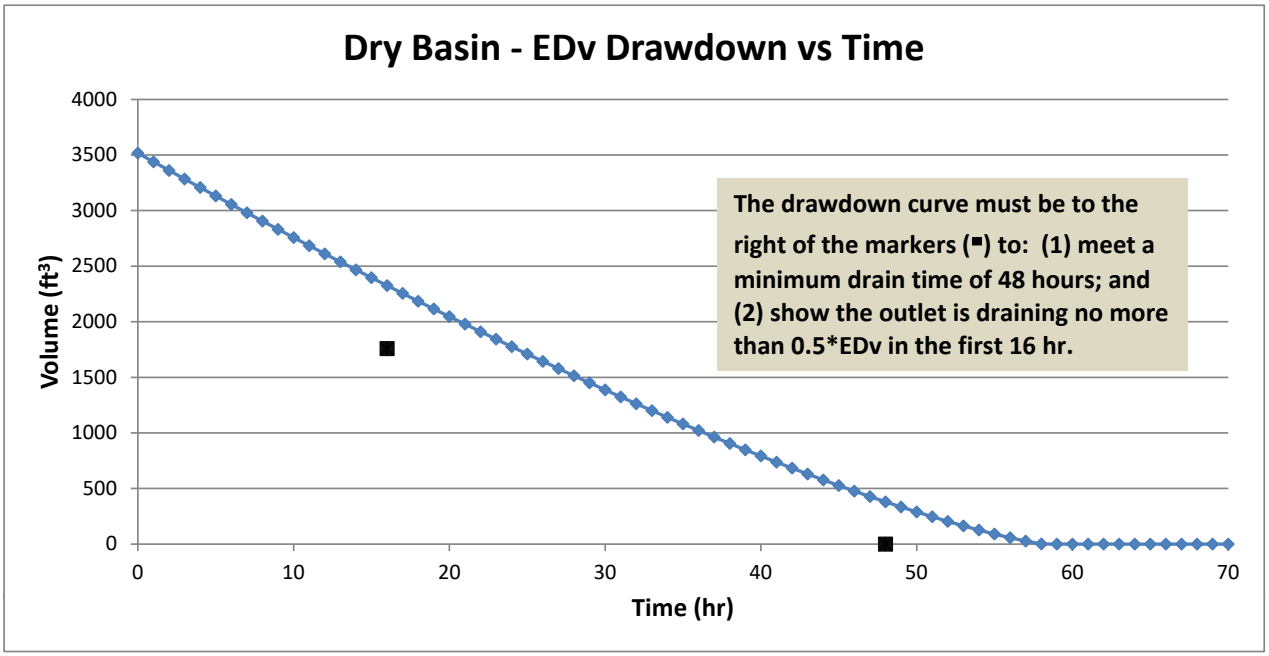
	Elevation ft	Area ft^2		Incremental Volume ft^3	Cumulative Volume ft^3
Bottom of Permanent Micropool =	1075.70	0			
(include forebay area if below EDv)	1076.00	636		64	64
	1077.00	3,497		1,875	1,938
	1078.00	4,426		3,952	5,891
	1079.00	5,433		4,921	10,812
	1079.80	6,338		4,704	15,515
	1079.96	9,149		1,232	16,748

Step 4 - Outlet Elevations and Storage Volumes

WQ Orifice Invert Elevation =	1075.70				
Elevation of Top of EDv =	1077.43				
Secondary Outlet Invert Elevation =	1077.51				OKAY
WQ Treatment Volume Provided, $V_{treatment}$ =	3,838	ft^3			
Treatment Vol Provided Relative to EDv, $V_{treatment}/EDv$ =	1.09		=	109%	OKAY
Permanent Pool Volume Provided, PPv =	0	ft^3			
Forebay Volume Provided, $V_{forebay}$ =	1,350	ft^3	=	3.84	
Is forebay volume below WQ outlet? (Yes or No)	No		=	384%	OKAY
Permanent Micropool Volume Provided, $V_{micropool}$ =	0	ft^3			
Ratio $V_{micropool}$ Provided to $V_{micropool}$ Required =	0.00		=	0%	NOT MET
Sediment Storage Volume Provided, $V_{sediment}$ =	1,350	ft^3			
Ratio $V_{sediment}$ Provided to $V_{sediment}$ Required =	1.92		=	192%	OKAY

Step 5 - Outlet (Orifice) Sizing

Maximum Hydraulic Head, Hmax =	1.73	ft			
Orifice Coefficient, C =	0.6				
Target (Minimum) Draw-down Time, T_d =	48	hr			
Target Average Discharge, Q_{avg} =	0.02	cfs			
Average Hydraulic Head, H_{avg} =	0.87	ft			
Estimated Orifice Area, $A_{orifice}$ =	0.65	in^2	=	0.005	ft^2
Estimated Orifice Diameter, $D_{orifice}$ =	0.91	in	=	0.08	ft
Design Orifice Diameter, $D_{orifice}$ =	0.80	in	=	0.07	ft
Design Orifice Area, $A_{orifice}$ =	0.50	in^2	=	0.003	ft^2
Time to Completely Drain EDv, T_d =	59	hr	must be ≥ 48 hr		OKAY
Volume Drained in First 16 hr =	1,192	ft^3			
% of EDv =	33.9	%	must be ≤ 50%		OKAY



SECTION 7

HYDROCAD CALCULATION SUMMARY – EXISTING CONDITIONS

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-yr	Type II 24-hr		Default	24.00	1	2.21	2
2	2-yr	Type II 24-hr		Default	24.00	1	2.64	2
3	5-yr	Type II 24-hr		Default	24.00	1	3.23	2
4	10-yr	Type II 24-hr		Default	24.00	1	3.71	2
5	25-yr	Type II 24-hr		Default	24.00	1	4.36	2
6	50-yr	Type II 24-hr		Default	24.00	1	4.89	2
7	100-yr	Type II 24-hr		Default	24.00	1	5.43	2

Summary for Subcatchment 3S: Existing Drainage Area

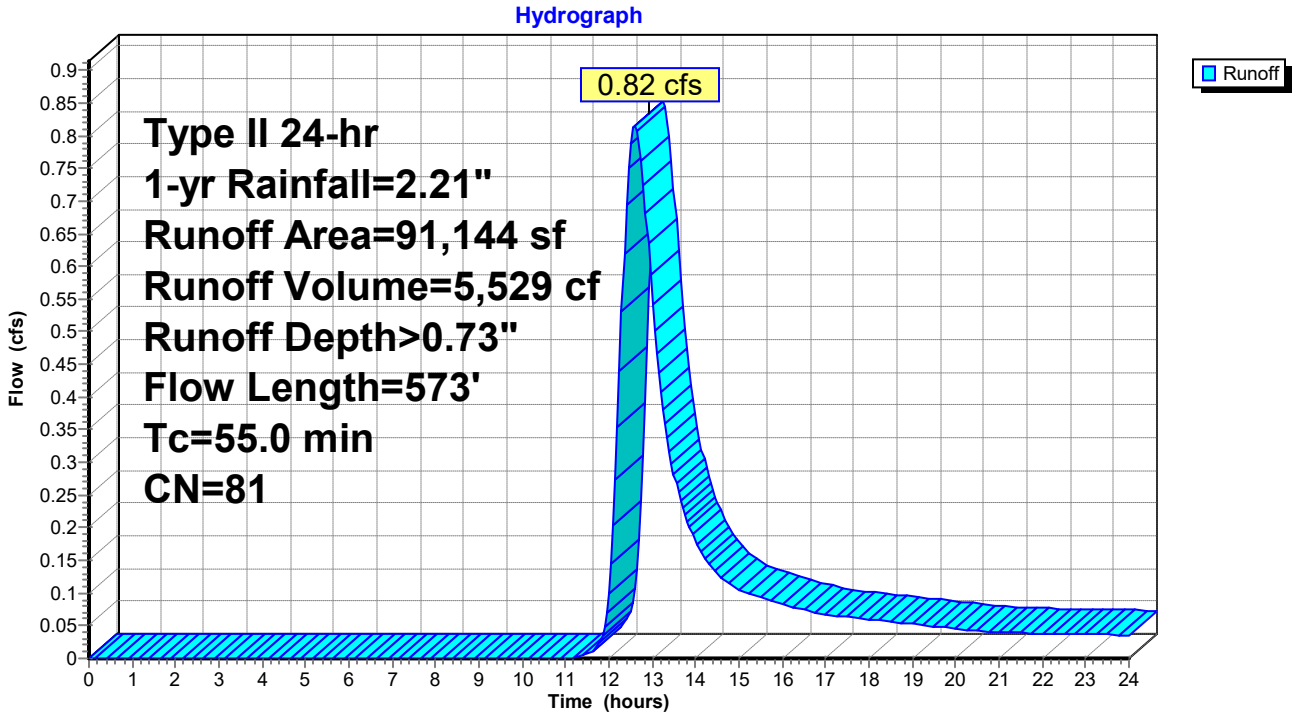
Runoff = 0.82 cfs @ 12.60 hrs, Volume= 5,529 cf, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.21"

Area (sf)	CN	Description
86,076	80	>75% Grass cover, Good, HSG D
5,068	98	Paved parking, HSG D
91,144	81	Weighted Average
86,076		94.44% Pervious Area
5,068		5.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
3.8	193	0.0032	0.85		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.7	79	0.0159	1.89		**Shallow Concentrated Flow, Run #3** Grassed Waterway Kv= 15.0 fps
0.2	49	0.1300	5.41		**Shallow Concentrated Flow, Run #4** Grassed Waterway Kv= 15.0 fps
1.3	152	0.0170	1.96		**Shallow Concentrated Flow, Run #5** Grassed Waterway Kv= 15.0 fps
55.0	573	Total			

Subcatchment 3S: Existing Drainage Area



Summary for Subcatchment 3S: Existing Drainage Area

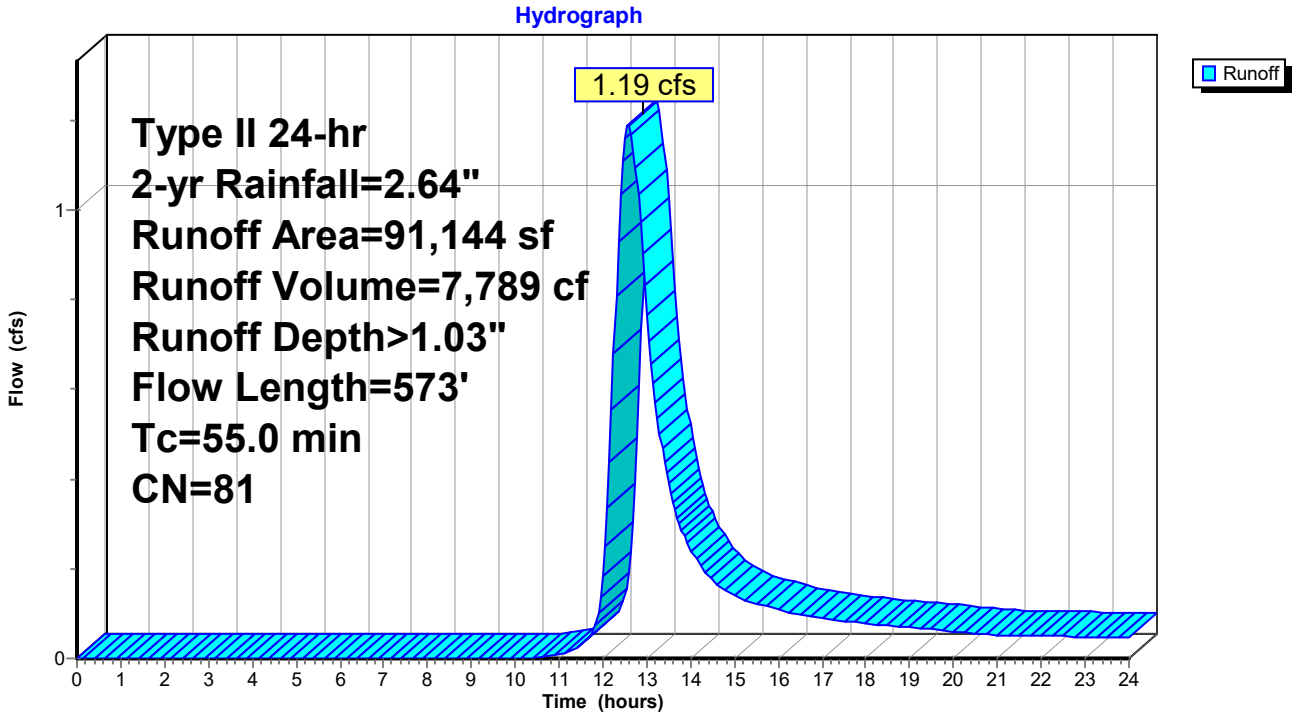
Runoff = 1.19 cfs @ 12.58 hrs, Volume= 7,789 cf, Depth> 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.64"

Area (sf)	CN	Description
86,076	80	>75% Grass cover, Good, HSG D
5,068	98	Paved parking, HSG D
91,144	81	Weighted Average
86,076		94.44% Pervious Area
5,068		5.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
3.8	193	0.0032	0.85		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.7	79	0.0159	1.89		**Shallow Concentrated Flow, Run #3** Grassed Waterway Kv= 15.0 fps
0.2	49	0.1300	5.41		**Shallow Concentrated Flow, Run #4** Grassed Waterway Kv= 15.0 fps
1.3	152	0.0170	1.96		**Shallow Concentrated Flow, Run #5** Grassed Waterway Kv= 15.0 fps
55.0	573	Total			

Subcatchment 3S: Existing Drainage Area



Summary for Subcatchment 3S: Existing Drainage Area

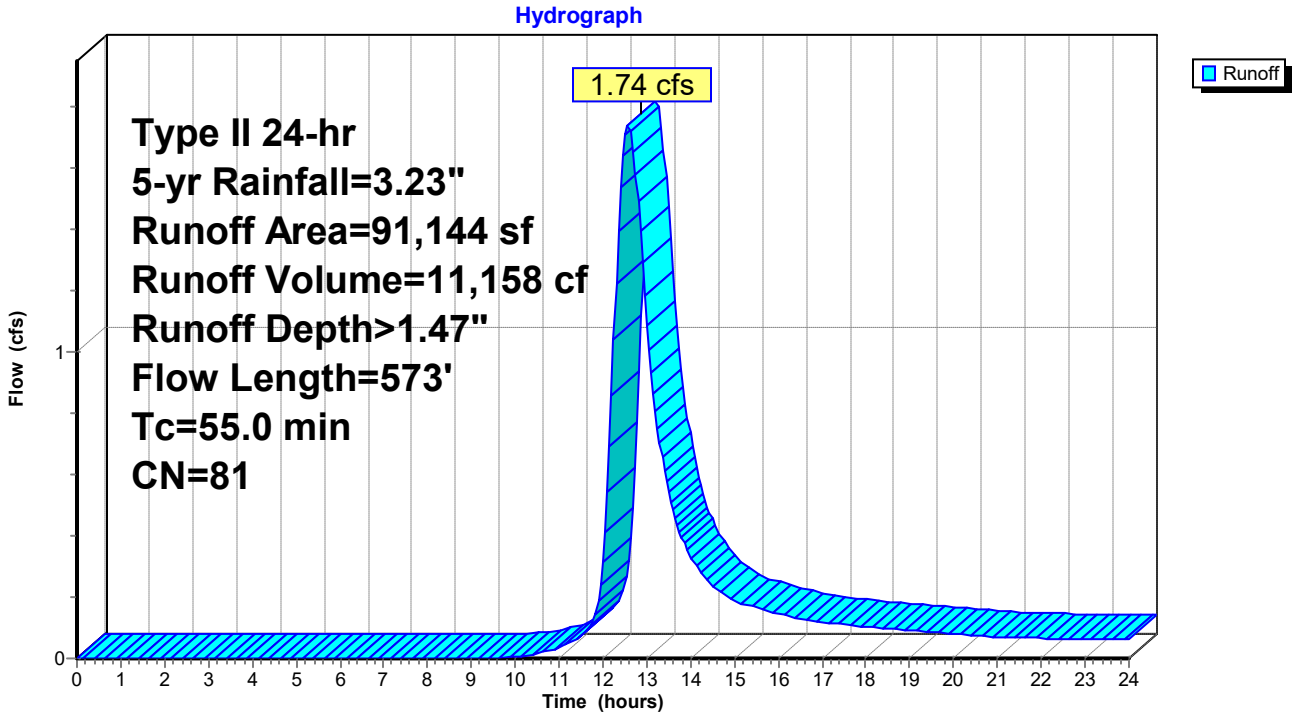
Runoff = 1.74 cfs @ 12.57 hrs, Volume= 11,158 cf, Depth> 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.23"

Area (sf)	CN	Description
86,076	80	>75% Grass cover, Good, HSG D
5,068	98	Paved parking, HSG D
91,144	81	Weighted Average
86,076		94.44% Pervious Area
5,068		5.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
3.8	193	0.0032	0.85		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.7	79	0.0159	1.89		**Shallow Concentrated Flow, Run #3** Grassed Waterway Kv= 15.0 fps
0.2	49	0.1300	5.41		**Shallow Concentrated Flow, Run #4** Grassed Waterway Kv= 15.0 fps
1.3	152	0.0170	1.96		**Shallow Concentrated Flow, Run #5** Grassed Waterway Kv= 15.0 fps
55.0	573	Total			

Subcatchment 3S: Existing Drainage Area



Summary for Subcatchment 3S: Existing Drainage Area

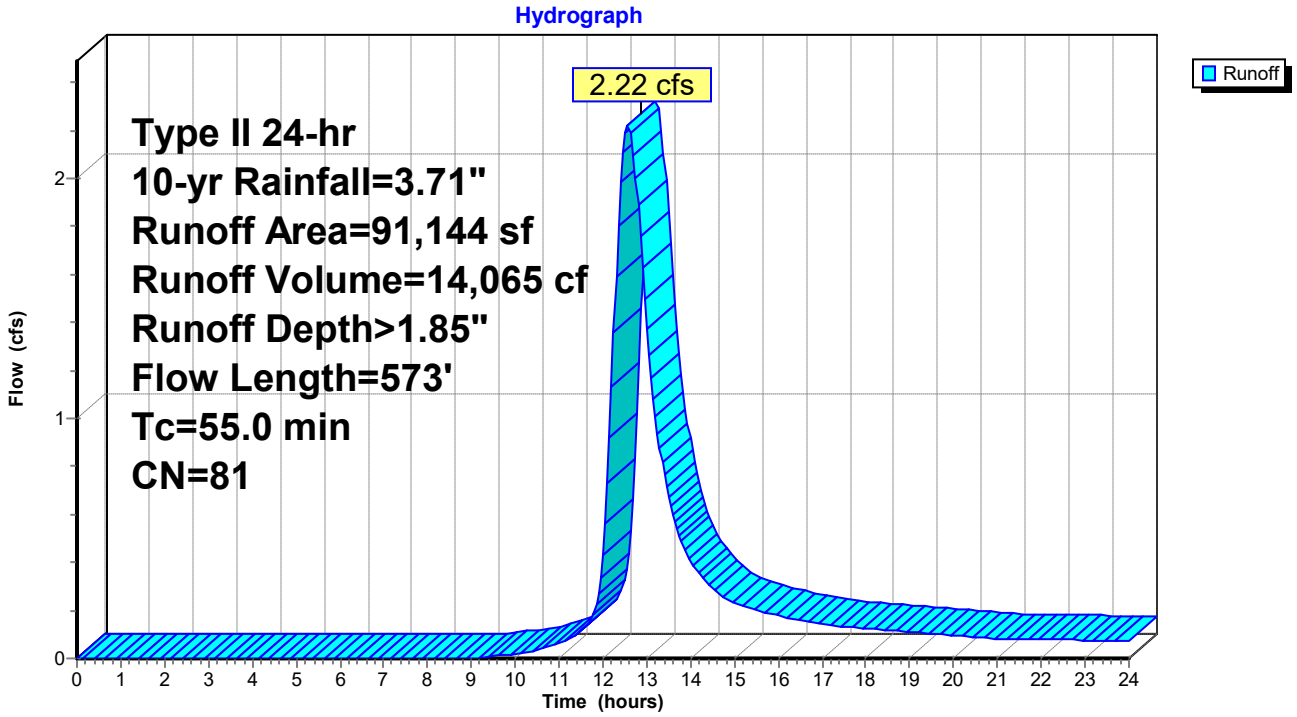
Runoff = 2.22 cfs @ 12.56 hrs, Volume= 14,065 cf, Depth> 1.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.71"

Area (sf)	CN	Description
86,076	80	>75% Grass cover, Good, HSG D
5,068	98	Paved parking, HSG D
91,144	81	Weighted Average
86,076		94.44% Pervious Area
5,068		5.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
3.8	193	0.0032	0.85		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.7	79	0.0159	1.89		**Shallow Concentrated Flow, Run #3** Grassed Waterway Kv= 15.0 fps
0.2	49	0.1300	5.41		**Shallow Concentrated Flow, Run #4** Grassed Waterway Kv= 15.0 fps
1.3	152	0.0170	1.96		**Shallow Concentrated Flow, Run #5** Grassed Waterway Kv= 15.0 fps
55.0	573	Total			

Subcatchment 3S: Existing Drainage Area



Summary for Subcatchment 3S: Existing Drainage Area

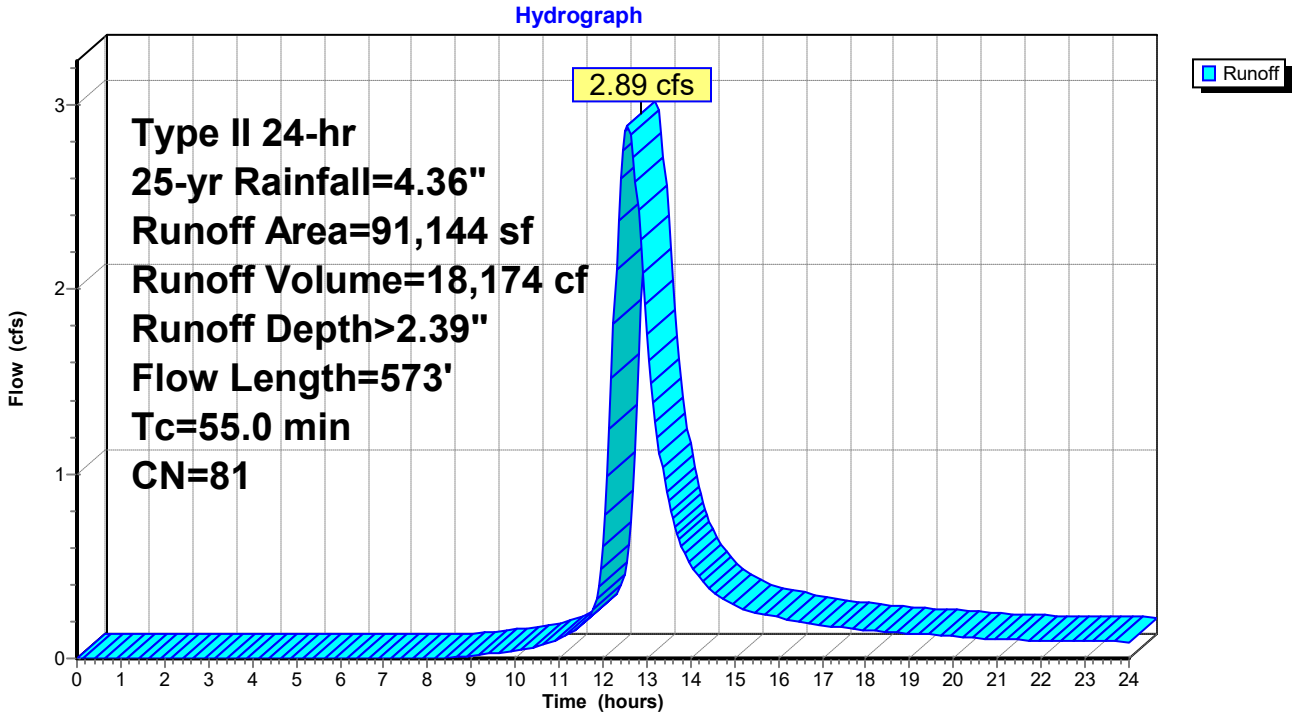
Runoff = 2.89 cfs @ 12.56 hrs, Volume= 18,174 cf, Depth> 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.36"

Area (sf)	CN	Description
86,076	80	>75% Grass cover, Good, HSG D
5,068	98	Paved parking, HSG D
91,144	81	Weighted Average
86,076		94.44% Pervious Area
5,068		5.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
3.8	193	0.0032	0.85		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.7	79	0.0159	1.89		**Shallow Concentrated Flow, Run #3** Grassed Waterway Kv= 15.0 fps
0.2	49	0.1300	5.41		**Shallow Concentrated Flow, Run #4** Grassed Waterway Kv= 15.0 fps
1.3	152	0.0170	1.96		**Shallow Concentrated Flow, Run #5** Grassed Waterway Kv= 15.0 fps
55.0	573	Total			

Subcatchment 3S: Existing Drainage Area



Summary for Subcatchment 3S: Existing Drainage Area

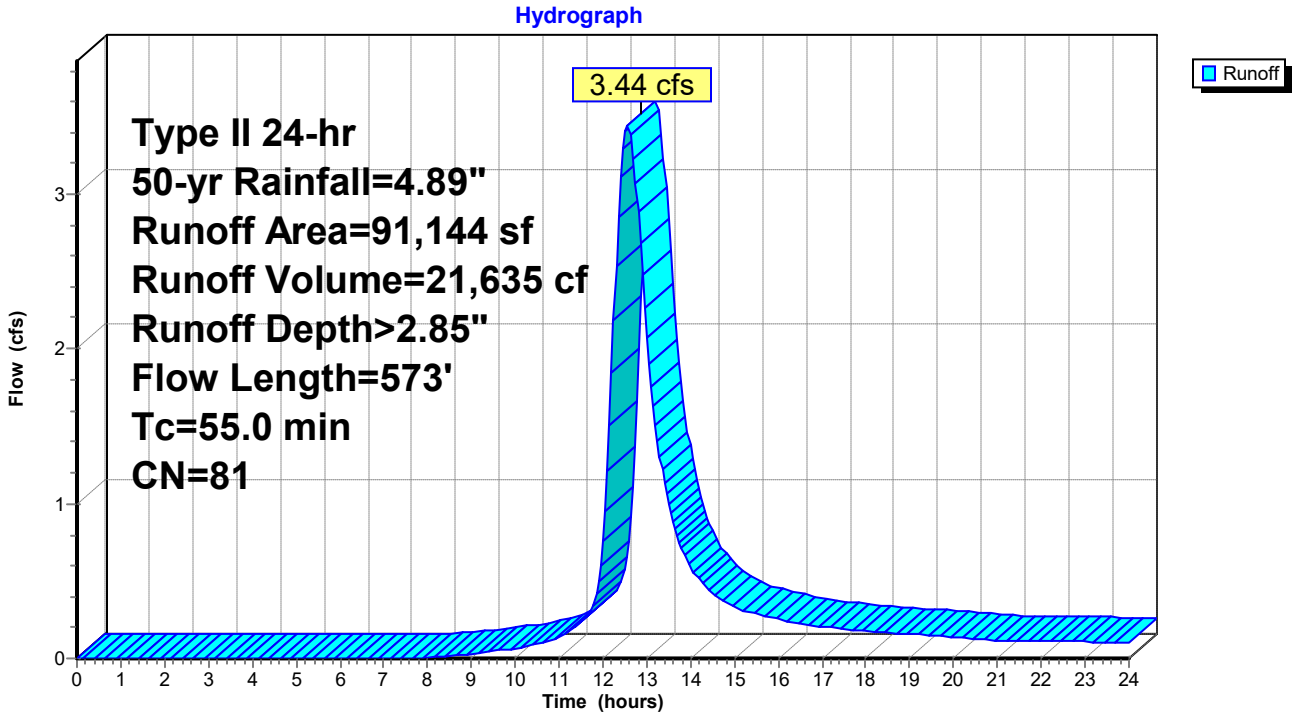
Runoff = 3.44 cfs @ 12.55 hrs, Volume= 21,635 cf, Depth> 2.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=4.89"

Area (sf)	CN	Description
86,076	80	>75% Grass cover, Good, HSG D
5,068	98	Paved parking, HSG D
91,144	81	Weighted Average
86,076		94.44% Pervious Area
5,068		5.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
3.8	193	0.0032	0.85		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.7	79	0.0159	1.89		**Shallow Concentrated Flow, Run #3** Grassed Waterway Kv= 15.0 fps
0.2	49	0.1300	5.41		**Shallow Concentrated Flow, Run #4** Grassed Waterway Kv= 15.0 fps
1.3	152	0.0170	1.96		**Shallow Concentrated Flow, Run #5** Grassed Waterway Kv= 15.0 fps
55.0	573	Total			

Subcatchment 3S: Existing Drainage Area



Summary for Subcatchment 3S: Existing Drainage Area

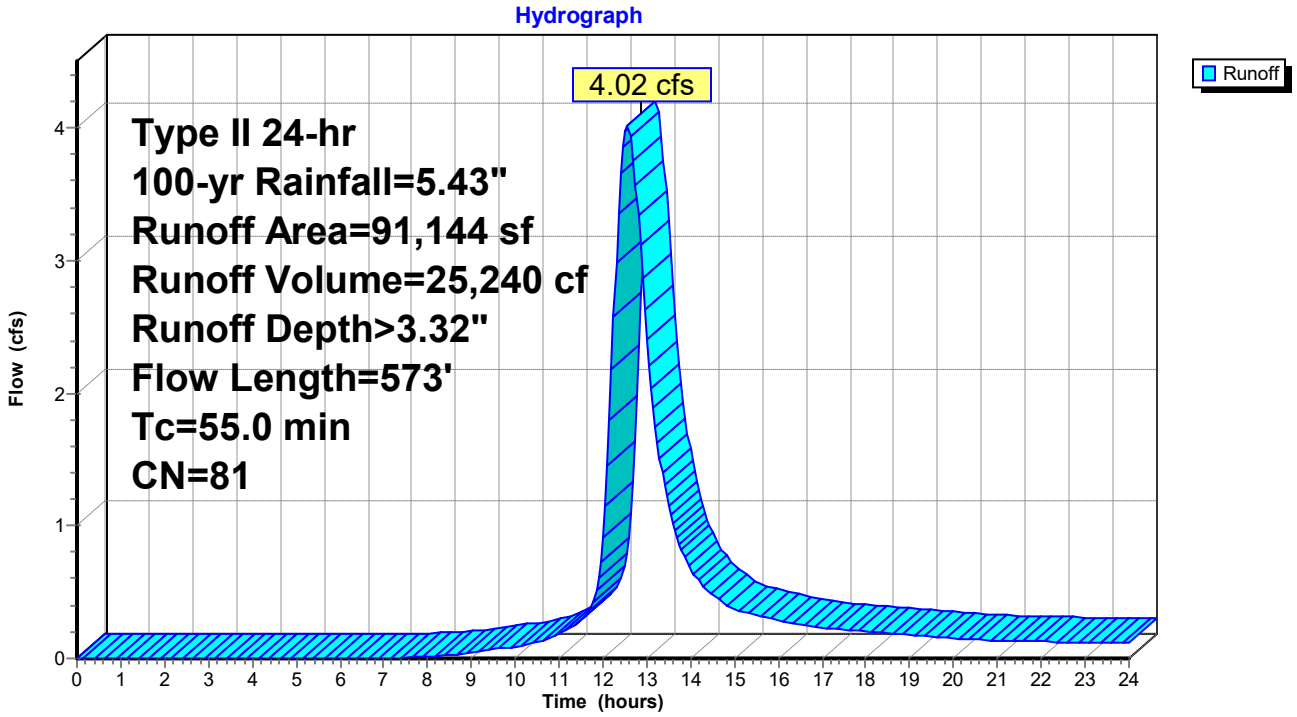
Runoff = 4.02 cfs @ 12.55 hrs, Volume= 25,240 cf, Depth> 3.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.43"

Area (sf)	CN	Description
86,076	80	>75% Grass cover, Good, HSG D
5,068	98	Paved parking, HSG D
91,144	81	Weighted Average
86,076		94.44% Pervious Area
5,068		5.56% Impervious Area

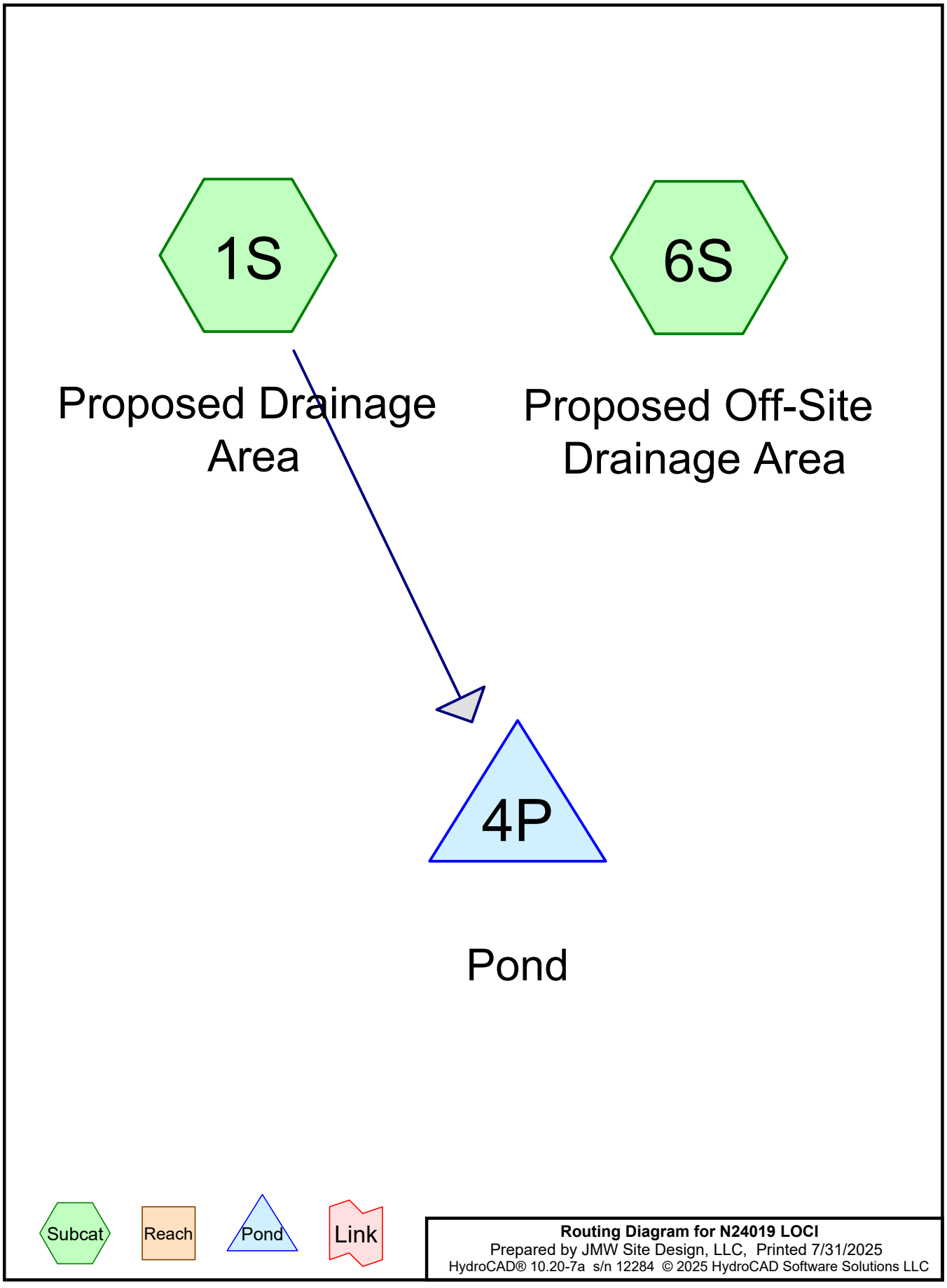
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
3.8	193	0.0032	0.85		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.7	79	0.0159	1.89		**Shallow Concentrated Flow, Run #3** Grassed Waterway Kv= 15.0 fps
0.2	49	0.1300	5.41		**Shallow Concentrated Flow, Run #4** Grassed Waterway Kv= 15.0 fps
1.3	152	0.0170	1.96		**Shallow Concentrated Flow, Run #5** Grassed Waterway Kv= 15.0 fps
55.0	573	Total			

Subcatchment 3S: Existing Drainage Area



SECTION 8

HYDROCAD CALCULATION SUMMARY – PROPOSED CONDITIONS



Routing Diagram for N24019 LOCI
Prepared by JMW Site Design, LLC, Printed 7/31/2025
HydroCAD® 10.20-7a s/n 12284 © 2025 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-yr	Type II 24-hr		Default	24.00	1	2.21	2
2	2-yr	Type II 24-hr		Default	24.00	1	2.64	2
3	5-yr	Type II 24-hr		Default	24.00	1	3.23	2
4	10-yr	Type II 24-hr		Default	24.00	1	3.71	2
5	25-yr	Type II 24-hr		Default	24.00	1	4.36	2
6	50-yr	Type II 24-hr		Default	24.00	1	4.89	2
7	100-yr	Type II 24-hr		Default	24.00	1	5.43	2

Summary for Subcatchment 1S: Proposed Drainage Area

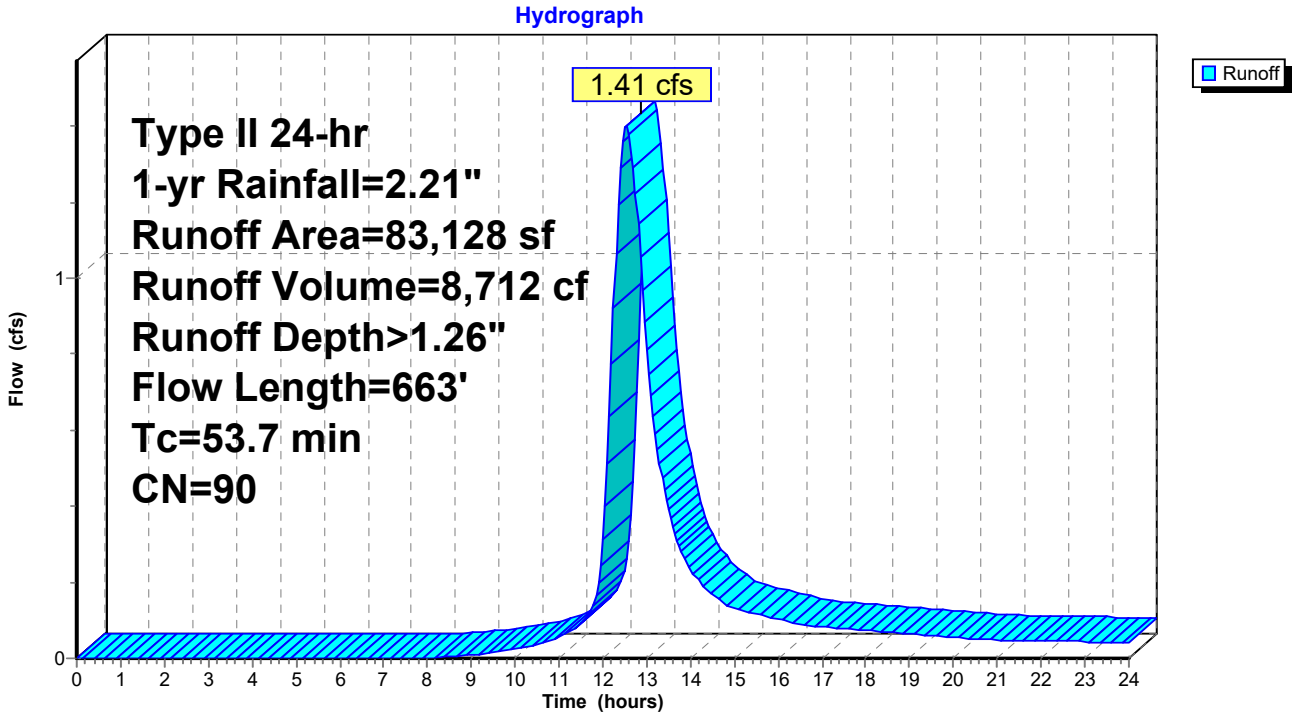
Runoff = 1.41 cfs @ 12.54 hrs, Volume= 8,712 cf, Depth> 1.26"
Routed to Pond 4P : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.21"

Area (sf)	CN	Description
47,377	98	Paved parking, HSG D
35,751	80	>75% Grass cover, Good, HSG D
83,128	90	Weighted Average
35,751		43.01% Pervious Area
47,377		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
2.6	133	0.0033	0.86		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.5	76	0.0150	2.49		**Shallow Concentrated Flow, Run #3** Paved Kv= 20.3 fps
0.2	42	0.0105	4.65	3.65	**Pipe Channel, Run #4** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.8	189	0.0075	3.93	3.09	**Pipe Channel, Run #5** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	123	0.0050	3.21	2.52	**Pipe Channel, Run #6** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
53.7	663	Total			

Subcatchment 1S: Proposed Drainage Area



Summary for Subcatchment 6S: Proposed Off-Site Drainage Area

[49] Hint: Tc<2dt may require smaller dt

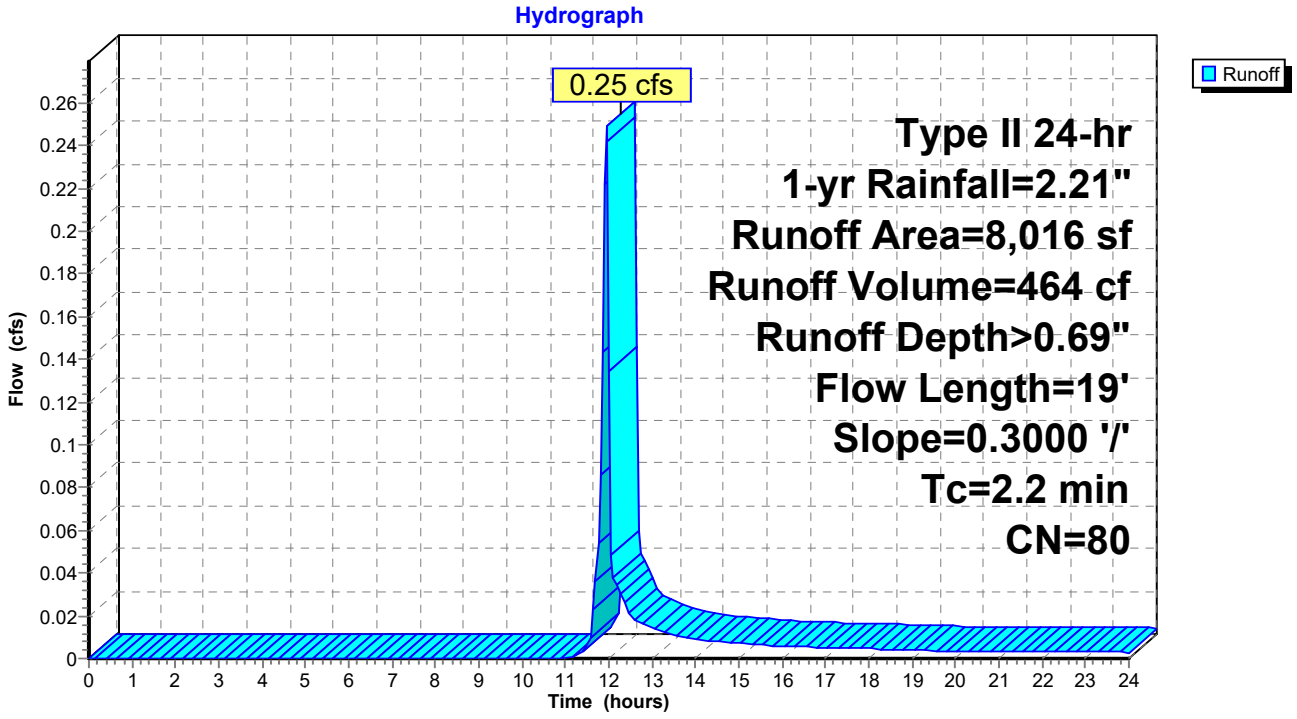
Runoff = 0.25 cfs @ 11.93 hrs, Volume= 464 cf, Depth> 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.21"

Area (sf)	CN	Description
8,016	80	>75% Grass cover, Good, HSG D
8,016		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	19	0.3000	0.15		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"

Subcatchment 6S: Proposed Off-Site Drainage Area



Summary for Pond 4P: Pond

Inflow Area = 83,128 sf, 56.99% Impervious, Inflow Depth > 1.26" for 1-yr event
Inflow = 1.41 cfs @ 12.54 hrs, Volume= 8,712 cf
Outflow = 0.31 cfs @ 13.70 hrs, Volume= 4,424 cf, Atten= 78%, Lag= 69.3 min
Primary = 0.31 cfs @ 13.70 hrs, Volume= 4,424 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,077.72' @ 13.70 hrs Surf.Area= 4,168 sf Storage= 4,928 cf

Plug-Flow detention time= 249.5 min calculated for 4,424 cf (51% of inflow)
Center-of-Mass det. time= 135.9 min (990.6 - 854.7)

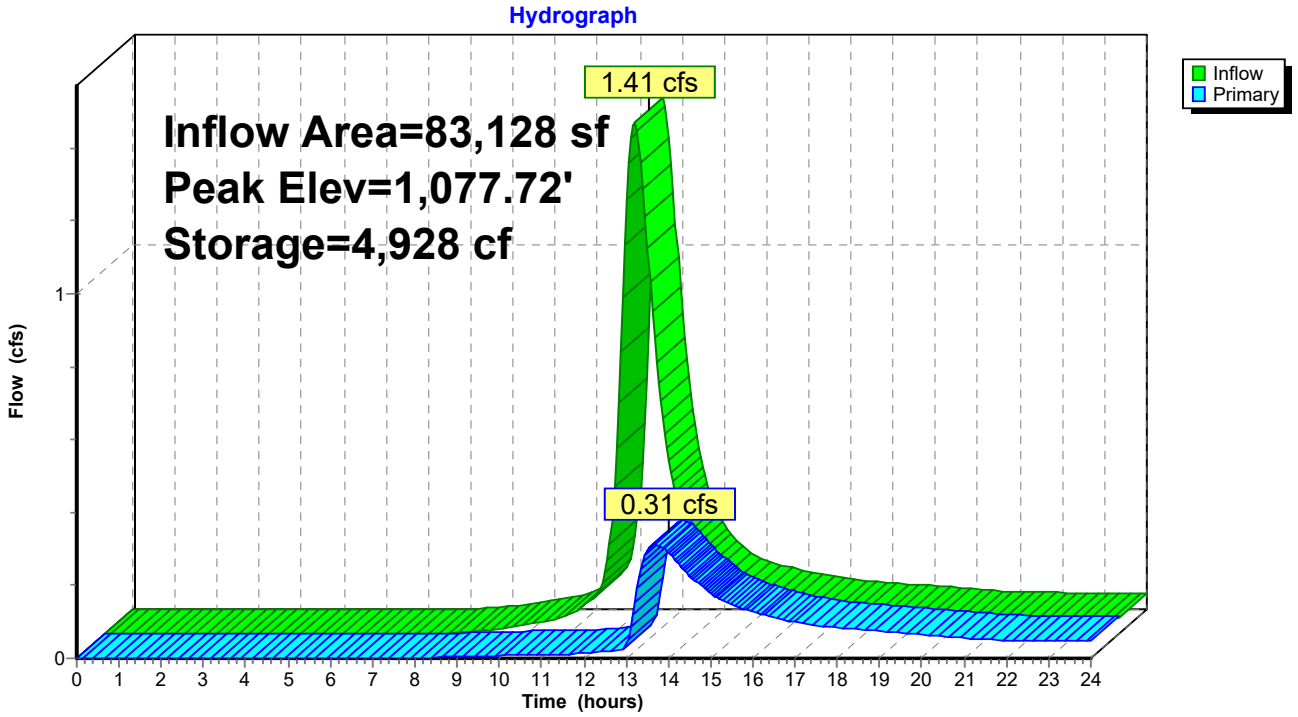
Volume	Invert	Avail.Storage	Storage Description
#1	1,075.70'	16,412 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,075.70	0	0	0
1,076.00	636	95	95
1,077.00	3,497	2,067	2,162
1,078.00	4,426	3,962	6,123
1,079.00	5,433	4,930	11,053
1,079.70	6,338	4,120	15,173
1,079.86	9,149	1,239	16,412

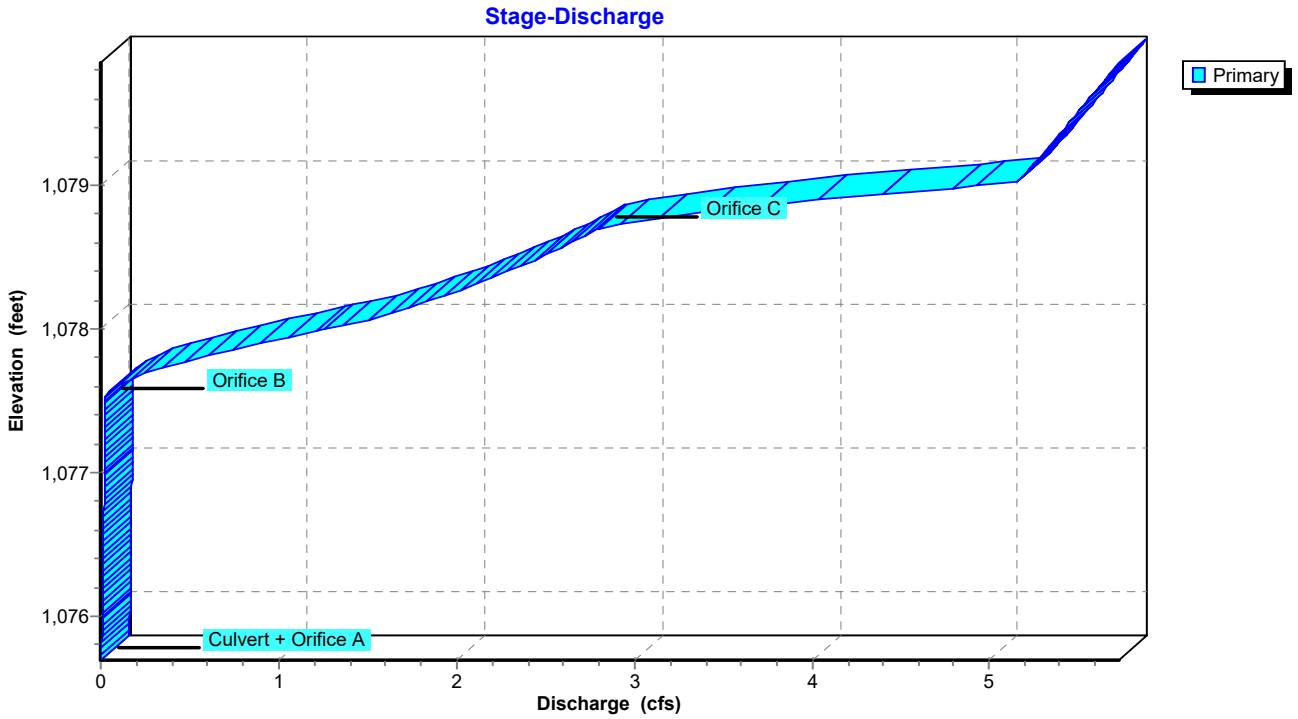
Device	Routing	Invert	Outlet Devices
#1	Primary	1,075.70'	**12.0" Round Culvert** L= 122.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,075.70' / 1,074.46' S= 0.0102 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	1,075.70'	**0.8" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,077.51'	**7.5" Vert. Orifice B X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	1,078.70'	**12.0" Horiz. Orifice C** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.31 cfs @ 13.70 hrs HW=1,077.72' TW=1,075.16' (Fixed TW Elev= 1,075.16')
└─**1=Culvert** (Passes 0.31 cfs of 4.11 cfs potential flow)
  ├─**2=Orifice A** (Orifice Controls 0.02 cfs @ 6.79 fps)
  ├─**3=Orifice B** (Orifice Controls 0.29 cfs @ 1.57 fps)
  └─**4=Orifice C** (Controls 0.00 cfs)

Pond 4P: Pond



Pond 4P: Pond



Summary for Subcatchment 1S: Proposed Drainage Area

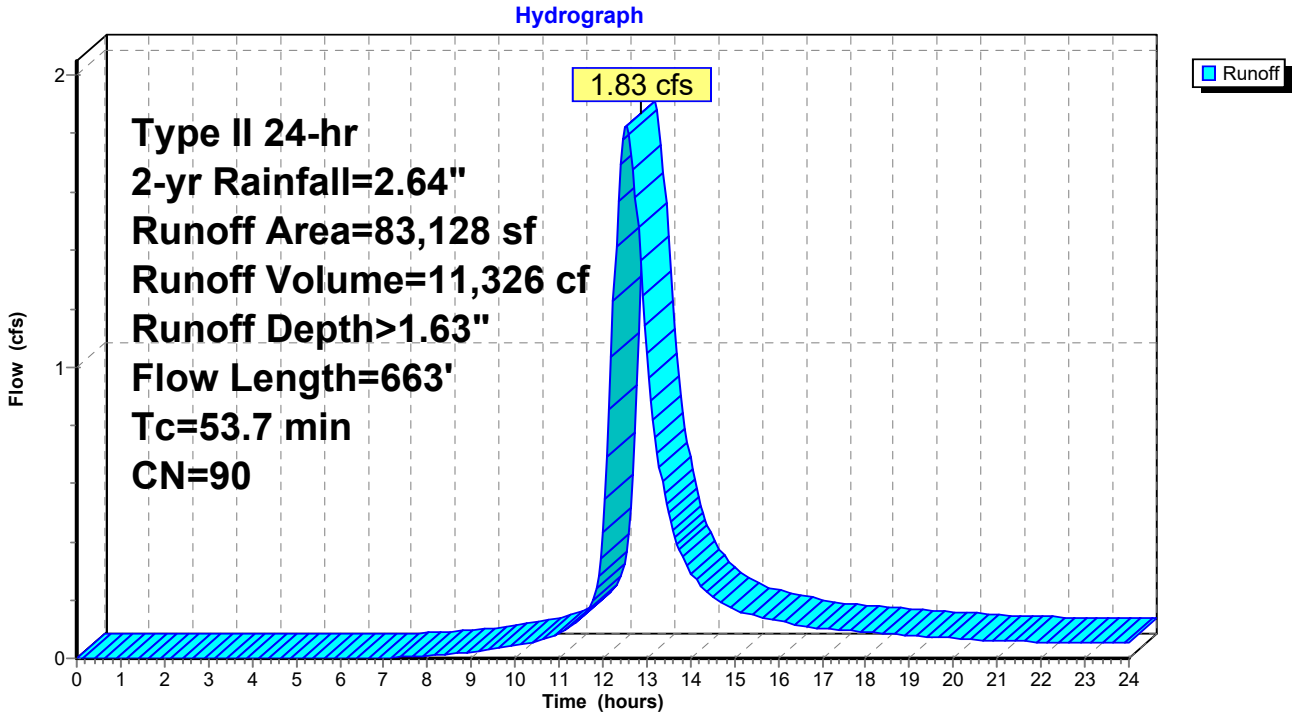
Runoff = 1.83 cfs @ 12.54 hrs, Volume= 11,326 cf, Depth> 1.63"
Routed to Pond 4P : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.64"

Area (sf)	CN	Description
47,377	98	Paved parking, HSG D
35,751	80	>75% Grass cover, Good, HSG D
83,128	90	Weighted Average
35,751		43.01% Pervious Area
47,377		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
2.6	133	0.0033	0.86		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.5	76	0.0150	2.49		**Shallow Concentrated Flow, Run #3** Paved Kv= 20.3 fps
0.2	42	0.0105	4.65	3.65	**Pipe Channel, Run #4** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.8	189	0.0075	3.93	3.09	**Pipe Channel, Run #5** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	123	0.0050	3.21	2.52	**Pipe Channel, Run #6** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
53.7	663	Total			

Subcatchment 1S: Proposed Drainage Area



Summary for Subcatchment 6S: Proposed Off-Site Drainage Area

[49] Hint: Tc<2dt may require smaller dt

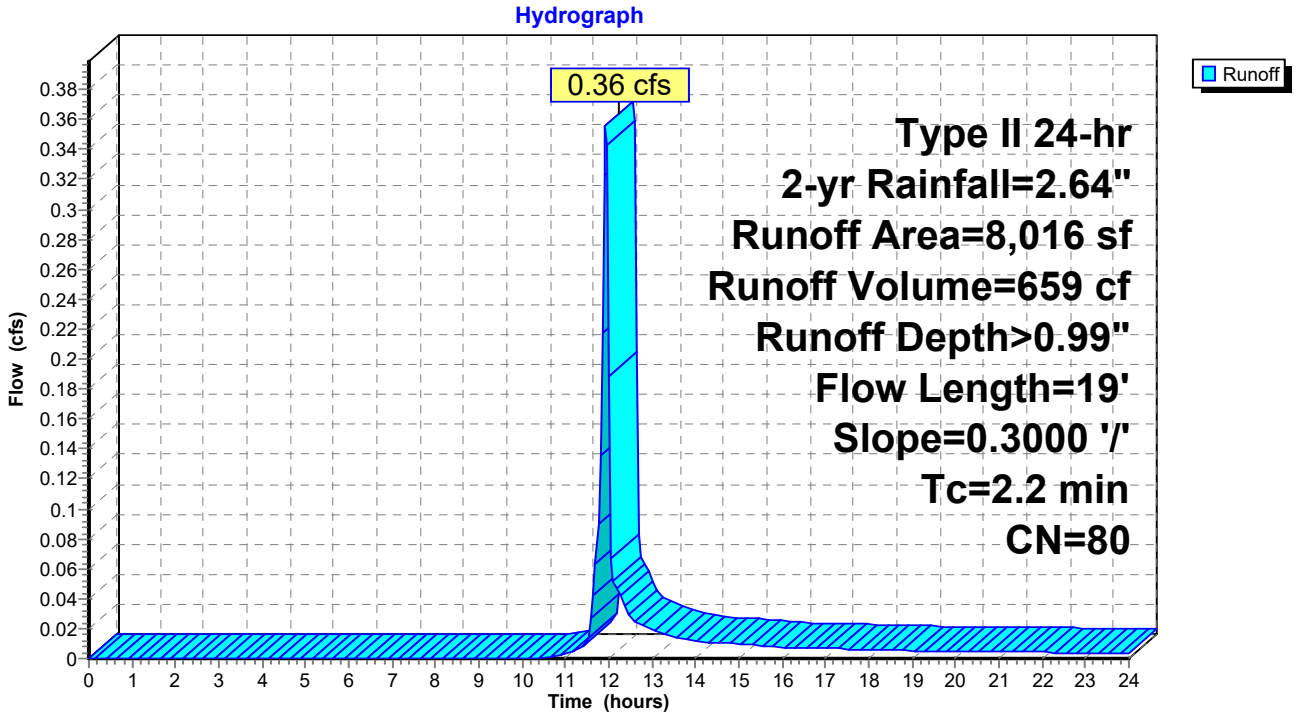
Runoff = 0.36 cfs @ 11.93 hrs, Volume= 659 cf, Depth> 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.64"

Area (sf)	CN	Description
8,016	80	>75% Grass cover, Good, HSG D
8,016		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	19	0.3000	0.15		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"

Subcatchment 6S: Proposed Off-Site Drainage Area



Summary for Pond 4P: Pond

Inflow Area = 83,128 sf, 56.99% Impervious, Inflow Depth > 1.63" for 2-yr event
Inflow = 1.83 cfs @ 12.54 hrs, Volume= 11,326 cf
Outflow = 0.72 cfs @ 13.23 hrs, Volume= 6,993 cf, Atten= 60%, Lag= 41.7 min
Primary = 0.72 cfs @ 13.23 hrs, Volume= 6,993 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,077.86' @ 13.23 hrs Surf.Area= 4,292 sf Storage= 5,495 cf

Plug-Flow detention time= 201.1 min calculated for 6,993 cf (62% of inflow)
Center-of-Mass det. time= 98.6 min (946.2 - 847.6)

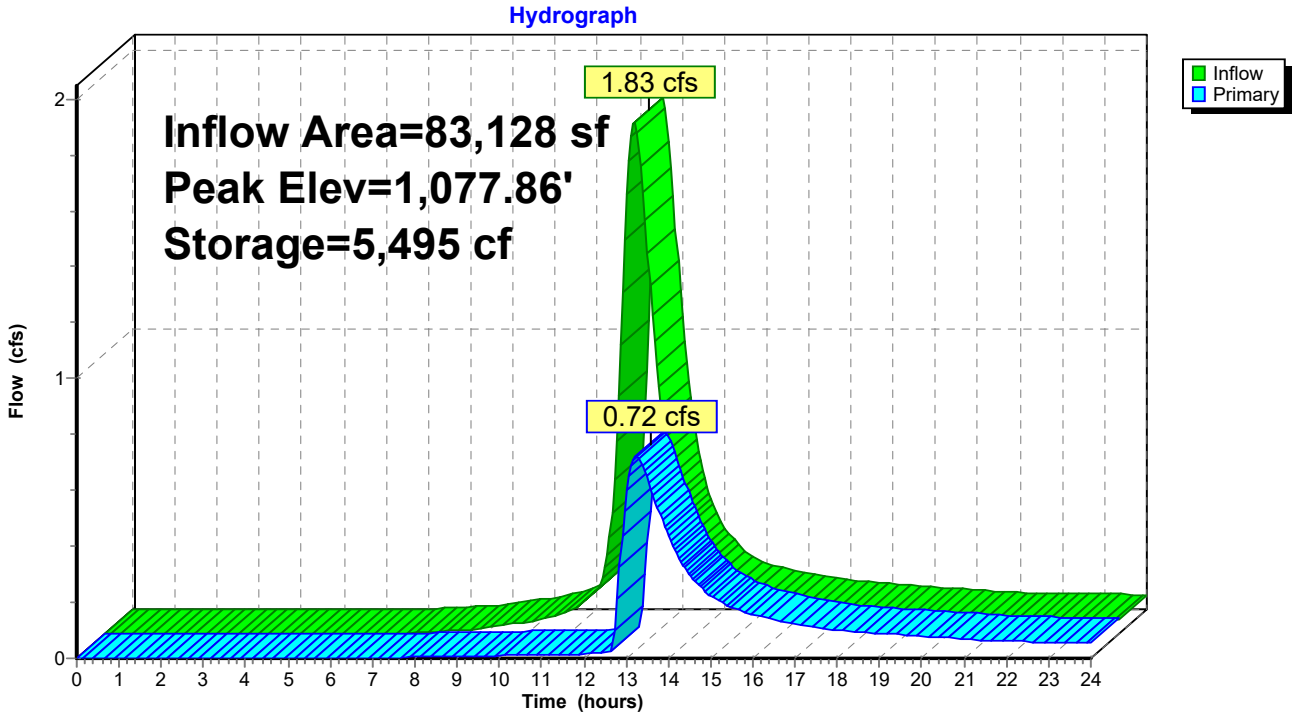
Volume	Invert	Avail.Storage	Storage Description
#1	1,075.70'	16,412 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,075.70	0	0	0
1,076.00	636	95	95
1,077.00	3,497	2,067	2,162
1,078.00	4,426	3,962	6,123
1,079.00	5,433	4,930	11,053
1,079.70	6,338	4,120	15,173
1,079.86	9,149	1,239	16,412

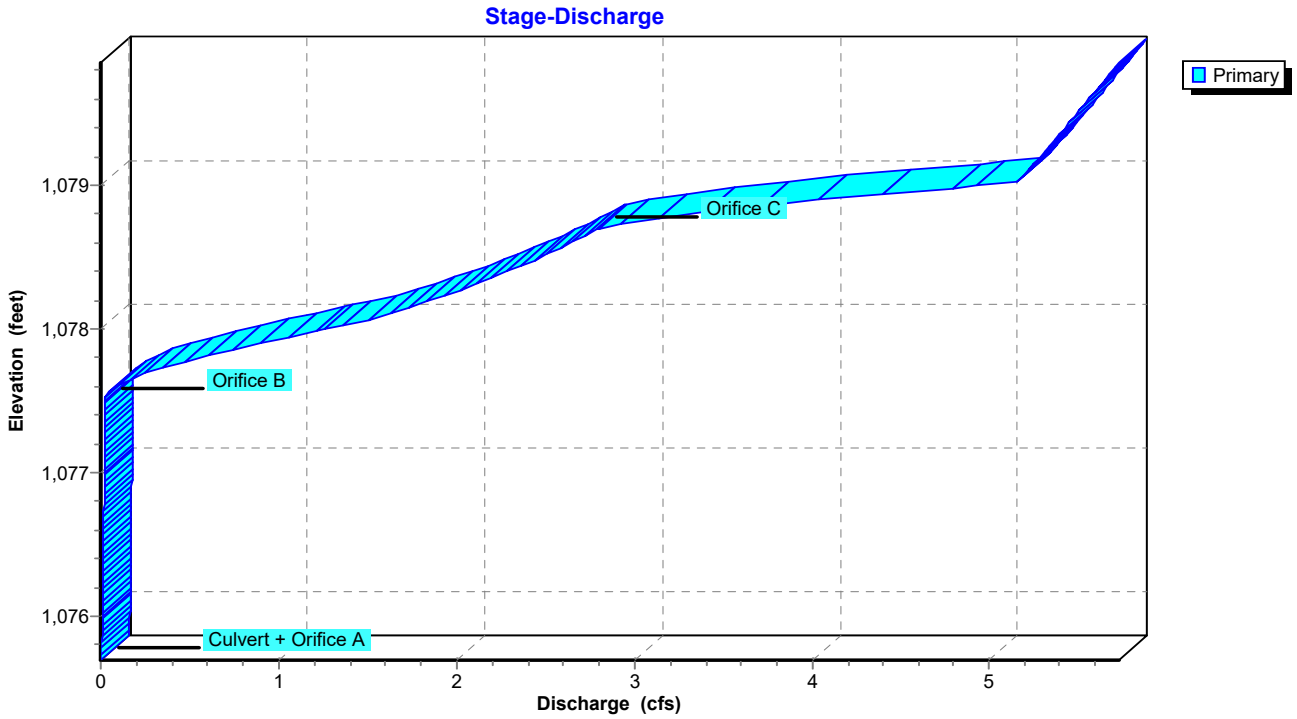
Device	Routing	Invert	Outlet Devices
#1	Primary	1,075.70'	**12.0" Round Culvert** L= 122.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,075.70' / 1,074.46' S= 0.0102 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	1,075.70'	**0.8" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,077.51'	**7.5" Vert. Orifice B X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	1,078.70'	**12.0" Horiz. Orifice C** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.72 cfs @ 13.23 hrs HW=1,077.86' TW=1,075.16' (Fixed TW Elev= 1,075.16')
└─**1=Culvert** (Passes 0.72 cfs of 4.23 cfs potential flow)
  ├─**2=Orifice A** (Orifice Controls 0.02 cfs @ 7.01 fps)
  ├─**3=Orifice B** (Orifice Controls 0.70 cfs @ 2.00 fps)
  └─**4=Orifice C** (Controls 0.00 cfs)

Pond 4P: Pond



Pond 4P: Pond



Summary for Subcatchment 1S: Proposed Drainage Area

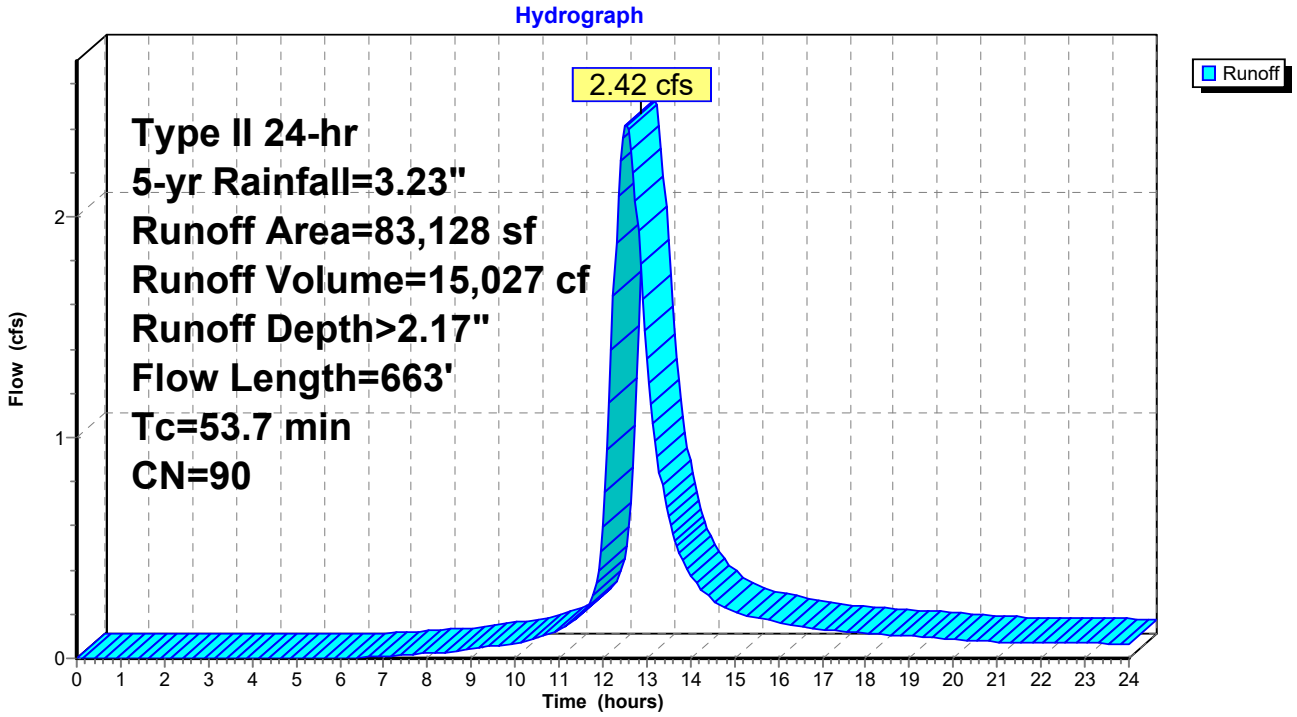
Runoff = 2.42 cfs @ 12.53 hrs, Volume= 15,027 cf, Depth> 2.17"
Routed to Pond 4P : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.23"

Area (sf)	CN	Description
47,377	98	Paved parking, HSG D
35,751	80	>75% Grass cover, Good, HSG D
83,128	90	Weighted Average
35,751		43.01% Pervious Area
47,377		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
2.6	133	0.0033	0.86		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.5	76	0.0150	2.49		**Shallow Concentrated Flow, Run #3** Paved Kv= 20.3 fps
0.2	42	0.0105	4.65	3.65	**Pipe Channel, Run #4** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.8	189	0.0075	3.93	3.09	**Pipe Channel, Run #5** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	123	0.0050	3.21	2.52	**Pipe Channel, Run #6** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
53.7	663	Total			

Subcatchment 1S: Proposed Drainage Area



Summary for Subcatchment 6S: Proposed Off-Site Drainage Area

[49] Hint: Tc<2dt may require smaller dt

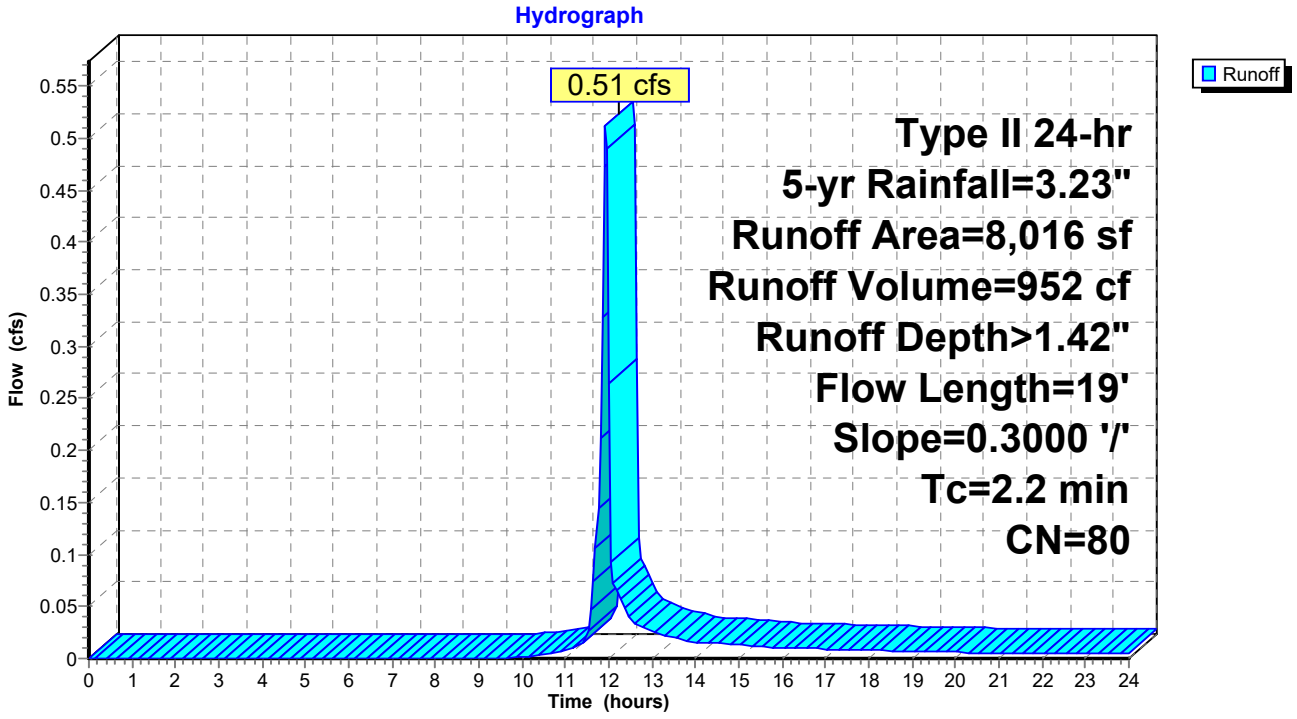
Runoff = 0.51 cfs @ 11.93 hrs, Volume= 952 cf, Depth> 1.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.23"

Area (sf)	CN	Description
8,016	80	>75% Grass cover, Good, HSG D
8,016		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	19	0.3000	0.15		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"

Subcatchment 6S: Proposed Off-Site Drainage Area



Summary for Pond 4P: Pond

Inflow Area = 83,128 sf, 56.99% Impervious, Inflow Depth > 2.17" for 5-yr event
Inflow = 2.42 cfs @ 12.53 hrs, Volume= 15,027 cf
Outflow = 1.36 cfs @ 13.00 hrs, Volume= 10,643 cf, Atten= 44%, Lag= 28.3 min
Primary = 1.36 cfs @ 13.00 hrs, Volume= 10,643 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,078.03' @ 13.00 hrs Surf.Area= 4,456 sf Storage= 6,256 cf

Plug-Flow detention time= 166.6 min calculated for 10,643 cf (71% of inflow)
Center-of-Mass det. time= 75.6 min (915.4 - 839.9)

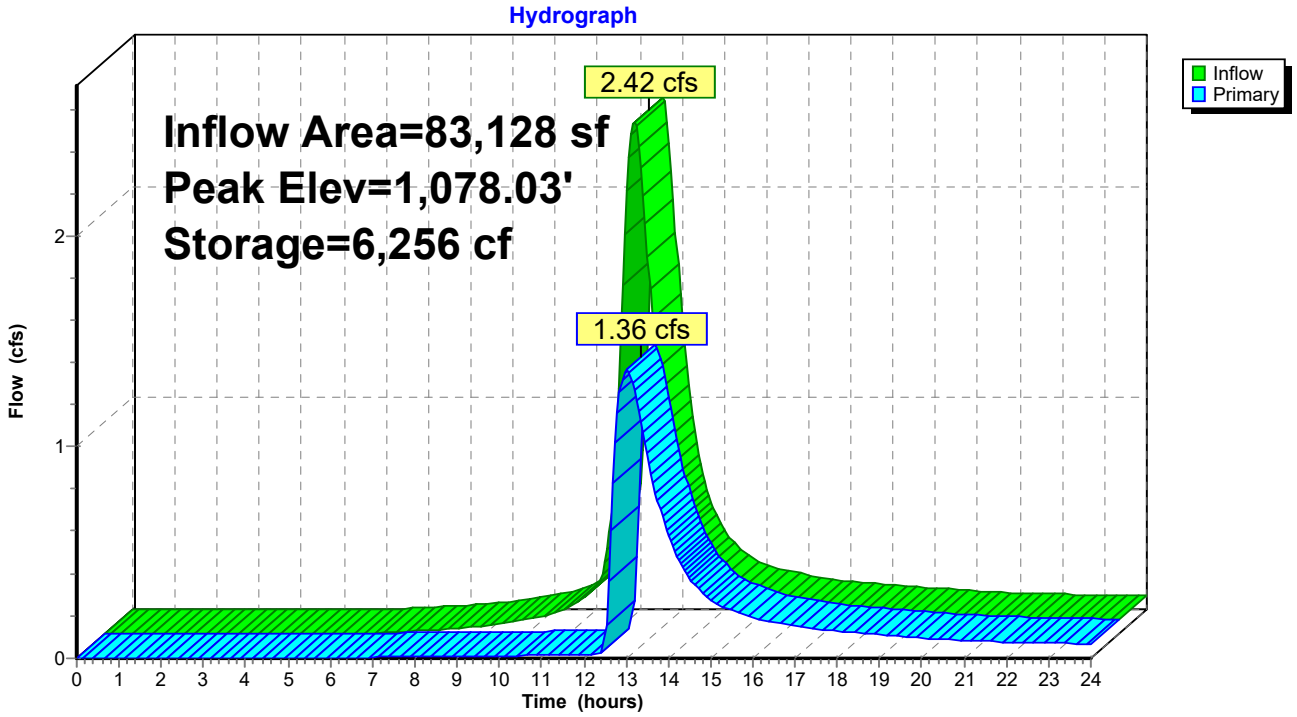
Volume	Invert	Avail.Storage	Storage Description
#1	1,075.70'	16,412 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,075.70	0	0	0
1,076.00	636	95	95
1,077.00	3,497	2,067	2,162
1,078.00	4,426	3,962	6,123
1,079.00	5,433	4,930	11,053
1,079.70	6,338	4,120	15,173
1,079.86	9,149	1,239	16,412

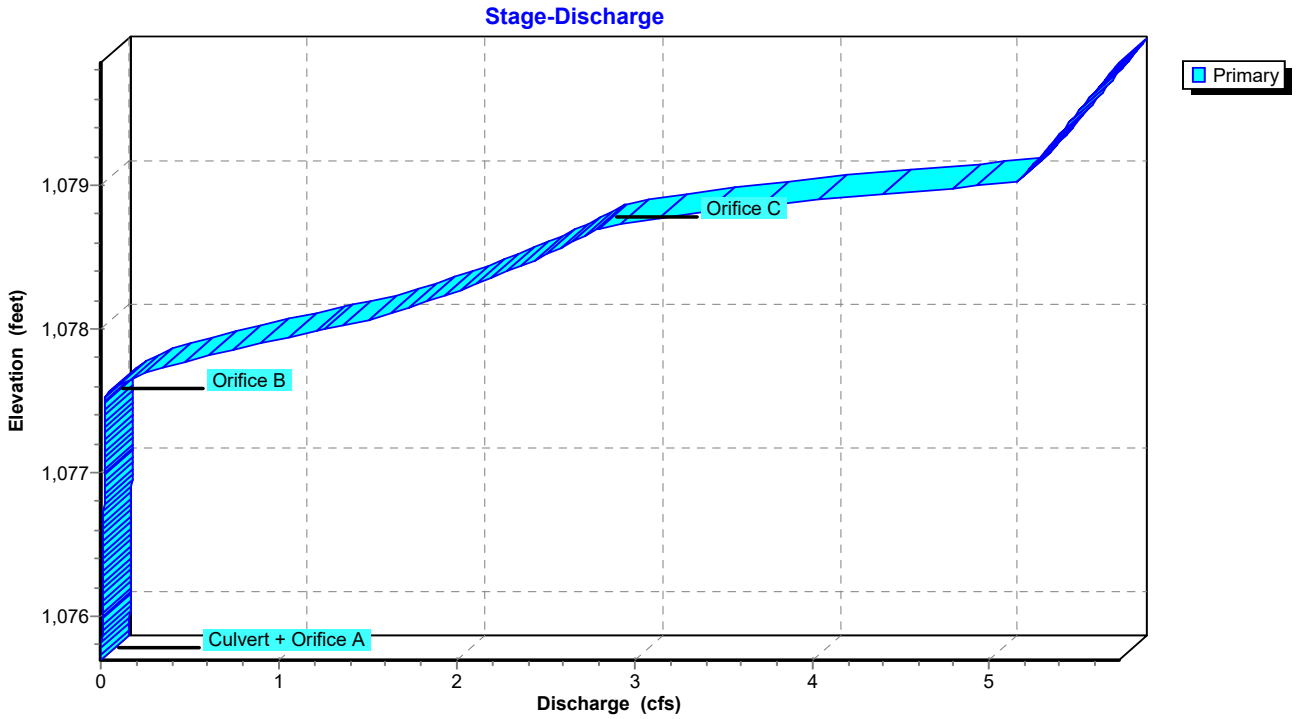
Device	Routing	Invert	Outlet Devices
#1	Primary	1,075.70'	**12.0" Round Culvert** L= 122.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,075.70' / 1,074.46' S= 0.0102 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	1,075.70'	**0.8" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,077.51'	**7.5" Vert. Orifice B X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	1,078.70'	**12.0" Horiz. Orifice C** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.36 cfs @ 13.00 hrs HW=1,078.03' TW=1,075.16' (Fixed TW Elev= 1,075.16')
└─**1=Culvert** (Passes 1.36 cfs of 4.38 cfs potential flow)
  ├─**2=Orifice A** (Orifice Controls 0.03 cfs @ 7.30 fps)
  ├─**3=Orifice B** (Orifice Controls 1.34 cfs @ 2.45 fps)
  └─**4=Orifice C** (Controls 0.00 cfs)

Pond 4P: Pond



Pond 4P: Pond



Summary for Subcatchment 1S: Proposed Drainage Area

[47] Hint: Peak is 115% of capacity of segment #6

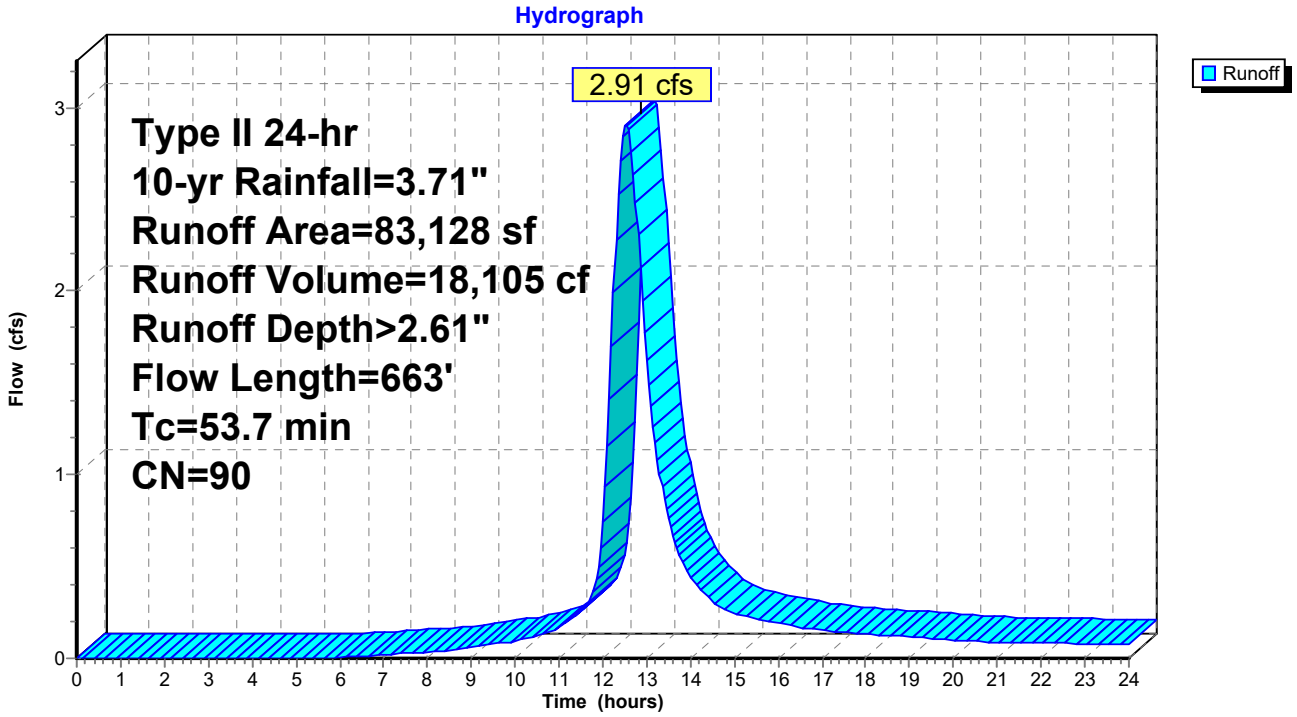
Runoff = 2.91 cfs @ 12.53 hrs, Volume= 18,105 cf, Depth> 2.61"
Routed to Pond 4P : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.71"

Area (sf)	CN	Description
47,377	98	Paved parking, HSG D
35,751	80	>75% Grass cover, Good, HSG D
83,128	90	Weighted Average
35,751		43.01% Pervious Area
47,377		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
2.6	133	0.0033	0.86		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.5	76	0.0150	2.49		**Shallow Concentrated Flow, Run #3** Paved Kv= 20.3 fps
0.2	42	0.0105	4.65	3.65	**Pipe Channel, Run #4** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.8	189	0.0075	3.93	3.09	**Pipe Channel, Run #5** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	123	0.0050	3.21	2.52	**Pipe Channel, Run #6** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
53.7	663	Total			

Subcatchment 1S: Proposed Drainage Area



Summary for Subcatchment 6S: Proposed Off-Site Drainage Area

[49] Hint: Tc<2dt may require smaller dt

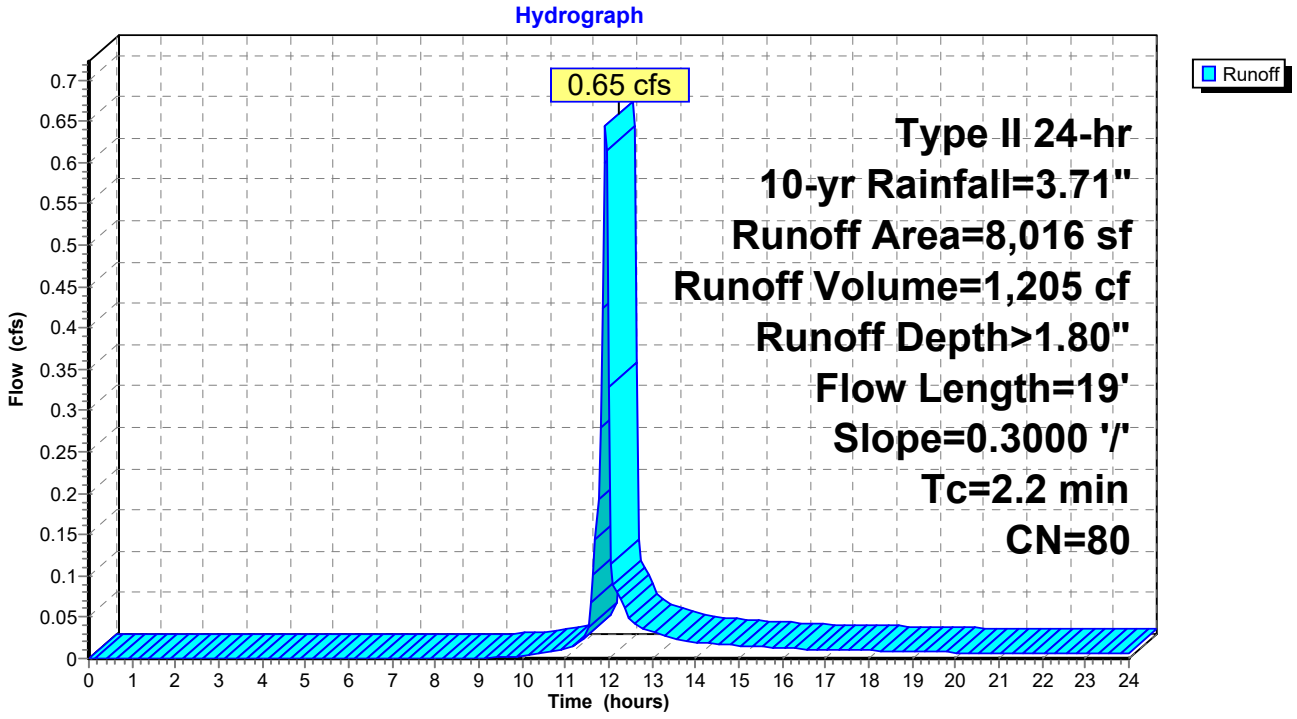
Runoff = 0.65 cfs @ 11.93 hrs, Volume= 1,205 cf, Depth> 1.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.71"

Area (sf)	CN	Description
8,016	80	>75% Grass cover, Good, HSG D
8,016		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	19	0.3000	0.15		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"

Subcatchment 6S: Proposed Off-Site Drainage Area



Summary for Pond 4P: Pond

Inflow Area = 83,128 sf, 56.99% Impervious, Inflow Depth > 2.61" for 10-yr event
Inflow = 2.91 cfs @ 12.53 hrs, Volume= 18,105 cf
Outflow = 1.79 cfs @ 12.95 hrs, Volume= 13,680 cf, Atten= 38%, Lag= 25.2 min
Primary = 1.79 cfs @ 12.95 hrs, Volume= 13,680 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,078.18' @ 12.95 hrs Surf.Area= 4,606 sf Storage= 6,932 cf

Plug-Flow detention time= 150.0 min calculated for 13,680 cf (76% of inflow)
Center-of-Mass det. time= 66.3 min (901.1 - 834.8)

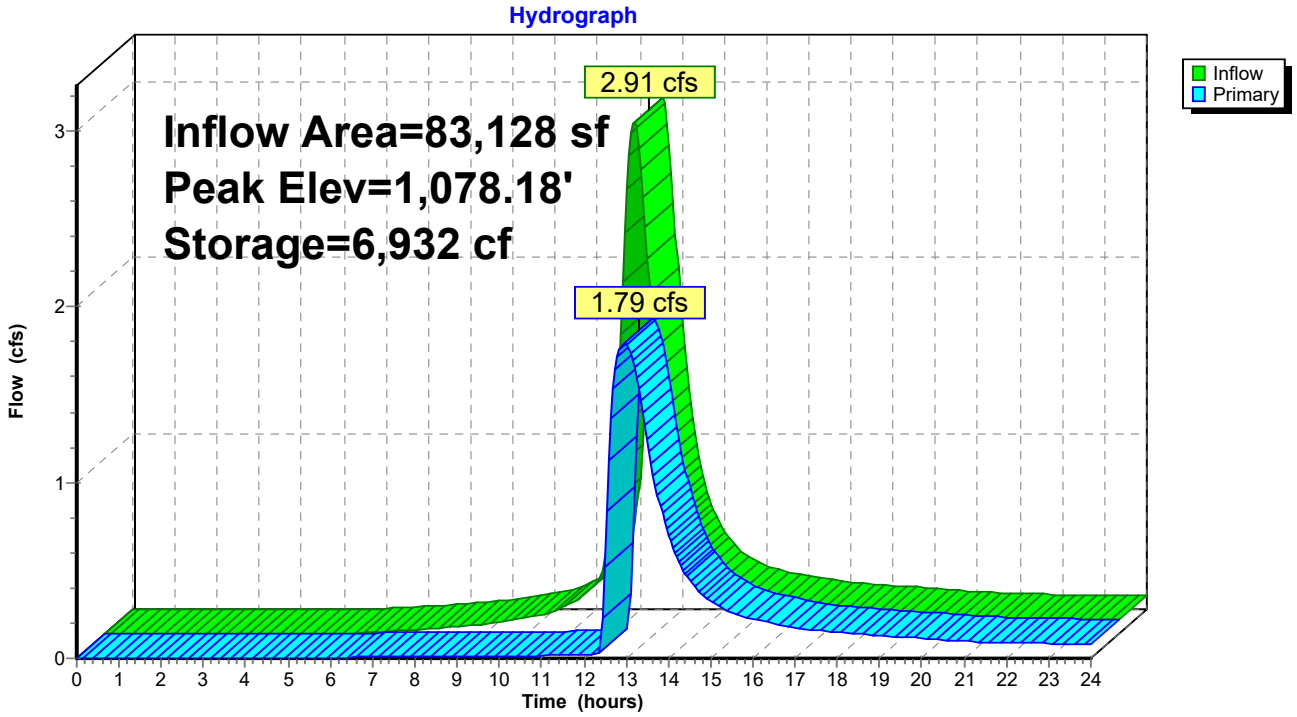
Volume	Invert	Avail.Storage	Storage Description
#1	1,075.70'	16,412 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,075.70	0	0	0
1,076.00	636	95	95
1,077.00	3,497	2,067	2,162
1,078.00	4,426	3,962	6,123
1,079.00	5,433	4,930	11,053
1,079.70	6,338	4,120	15,173
1,079.86	9,149	1,239	16,412

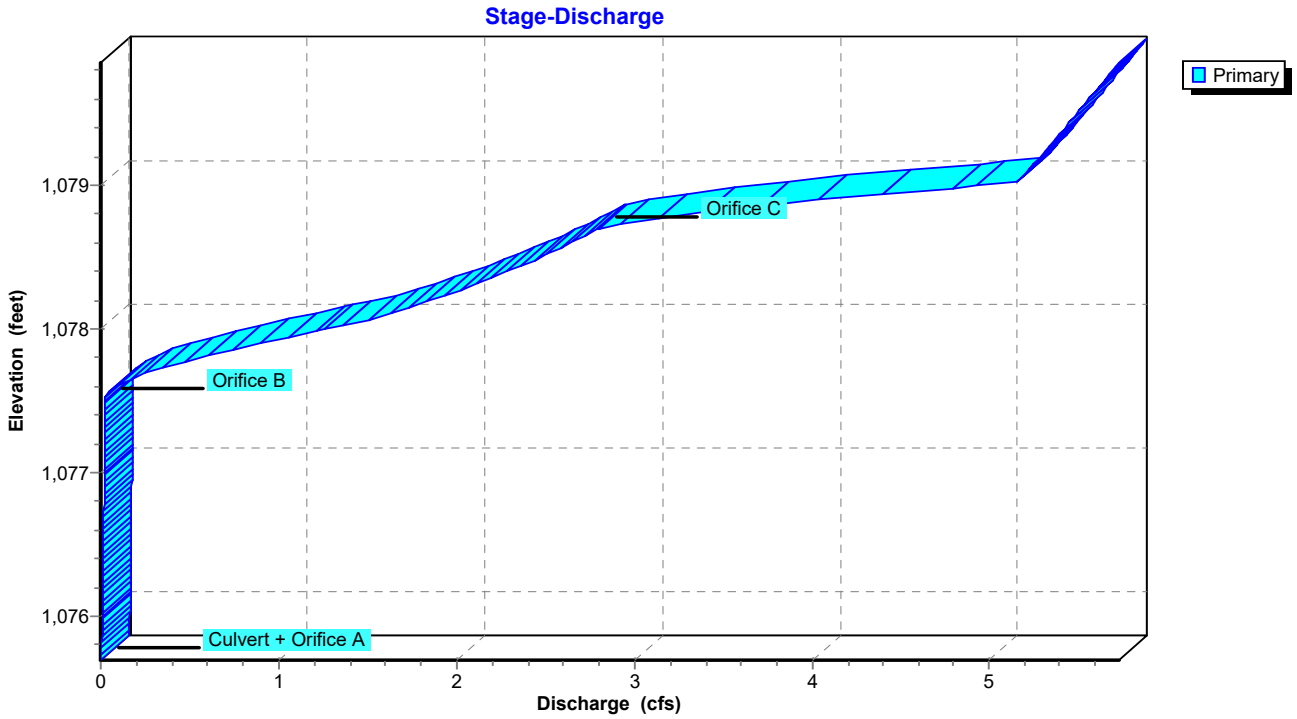
Device	Routing	Invert	Outlet Devices
#1	Primary	1,075.70'	**12.0" Round Culvert** L= 122.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,075.70' / 1,074.46' S= 0.0102 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	1,075.70'	**0.8" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,077.51'	**7.5" Vert. Orifice B X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	1,078.70'	**12.0" Horiz. Orifice C** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.79 cfs @ 12.95 hrs HW=1,078.18' TW=1,075.16' (Fixed TW Elev= 1,075.16')
└─**1=Culvert** (Passes 1.79 cfs of 4.50 cfs potential flow)
  ├─**2=Orifice A** (Orifice Controls 0.03 cfs @ 7.53 fps)
  ├─**3=Orifice B** (Orifice Controls 1.76 cfs @ 2.88 fps)
  └─**4=Orifice C** (Controls 0.00 cfs)

Pond 4P: Pond



Pond 4P: Pond



Summary for Subcatchment 1S: Proposed Drainage Area

[47] Hint: Peak is 116% of capacity of segment #5
[47] Hint: Peak is 142% of capacity of segment #6

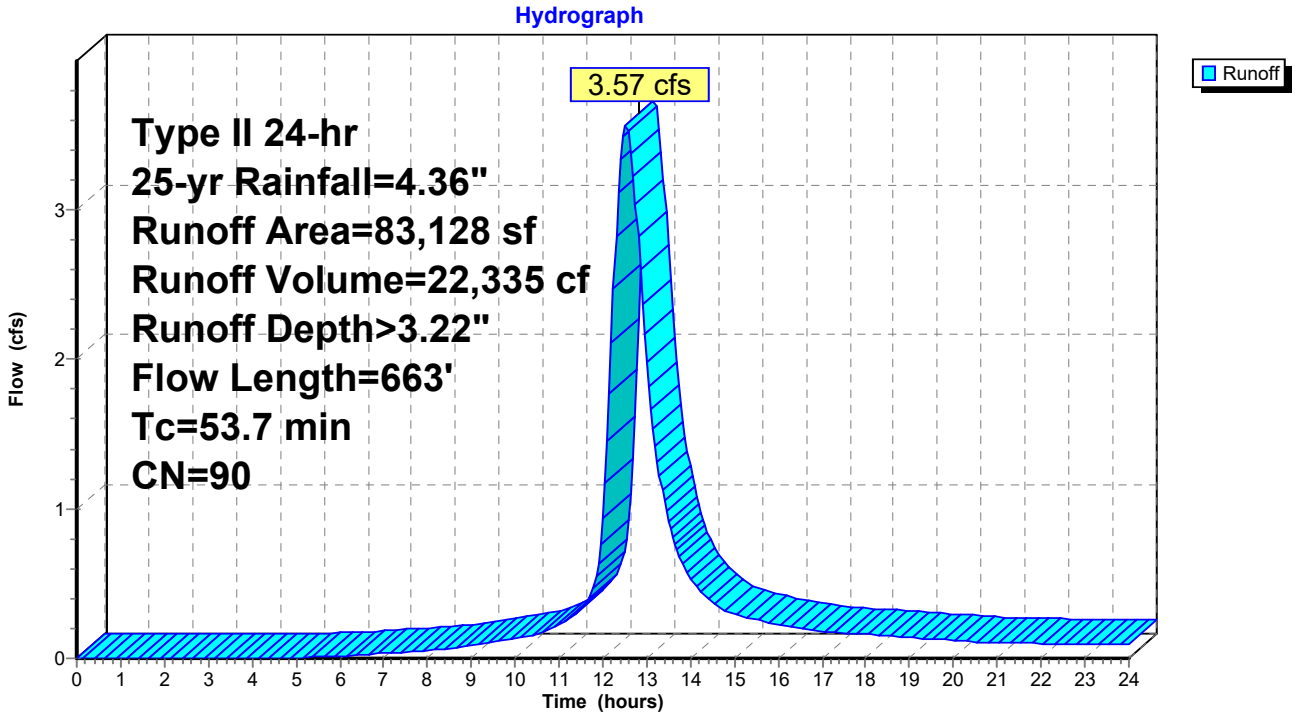
Runoff = 3.57 cfs @ 12.52 hrs, Volume= 22,335 cf, Depth> 3.22"
Routed to Pond 4P : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.36"

Area (sf)	CN	Description
47,377	98	Paved parking, HSG D
35,751	80	>75% Grass cover, Good, HSG D
83,128	90	Weighted Average
35,751		43.01% Pervious Area
47,377		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
2.6	133	0.0033	0.86		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.5	76	0.0150	2.49		**Shallow Concentrated Flow, Run #3** Paved Kv= 20.3 fps
0.2	42	0.0105	4.65	3.65	**Pipe Channel, Run #4** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.8	189	0.0075	3.93	3.09	**Pipe Channel, Run #5** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	123	0.0050	3.21	2.52	**Pipe Channel, Run #6** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
53.7	663	Total			

Subcatchment 1S: Proposed Drainage Area



Summary for Subcatchment 6S: Proposed Off-Site Drainage Area

[49] Hint: Tc<2dt may require smaller dt

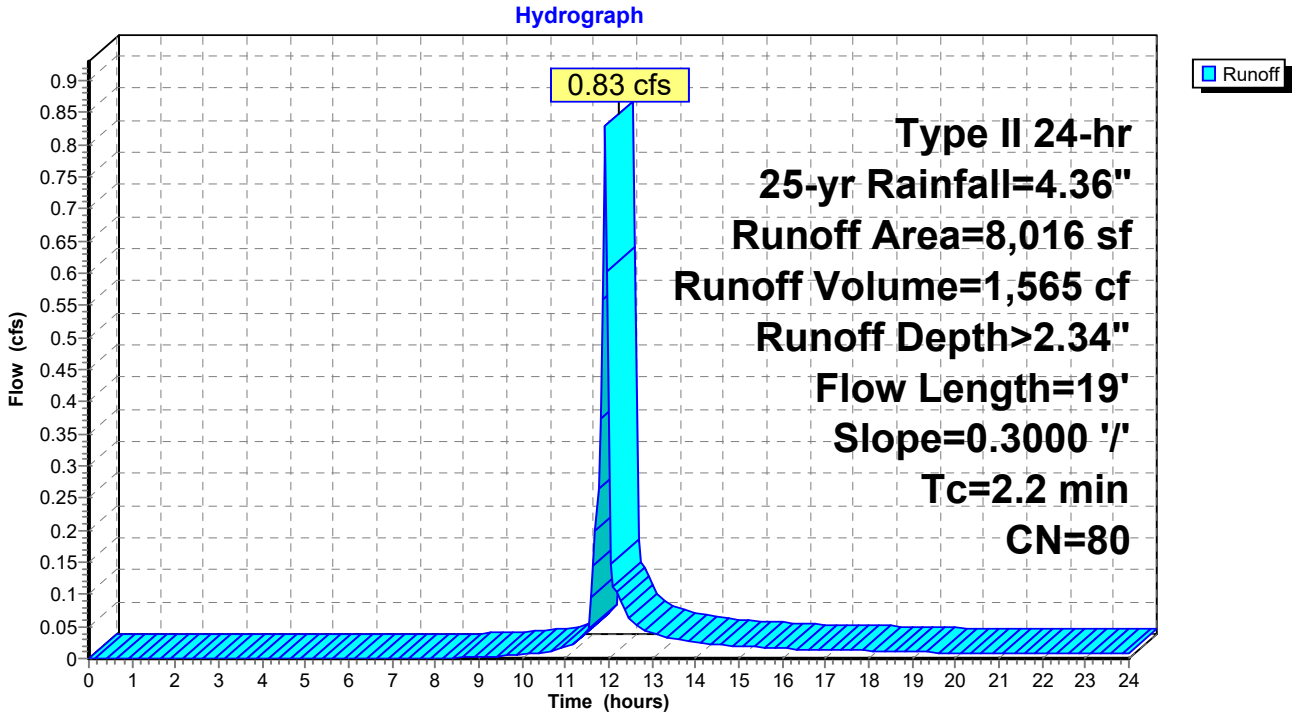
Runoff = 0.83 cfs @ 11.93 hrs, Volume= 1,565 cf, Depth> 2.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.36"

Area (sf)	CN	Description
8,016	80	>75% Grass cover, Good, HSG D
8,016		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	19	0.3000	0.15		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"

Subcatchment 6S: Proposed Off-Site Drainage Area



Summary for Pond 4P: Pond

Inflow Area = 83,128 sf, 56.99% Impervious, Inflow Depth > 3.22" for 25-yr event
Inflow = 3.57 cfs @ 12.52 hrs, Volume= 22,335 cf
Outflow = 2.27 cfs @ 12.92 hrs, Volume= 17,858 cf, Atten= 36%, Lag= 24.0 min
Primary = 2.27 cfs @ 12.92 hrs, Volume= 17,858 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,078.40' @ 12.92 hrs Surf.Area= 4,829 sf Storage= 7,977 cf

Plug-Flow detention time= 135.3 min calculated for 17,858 cf (80% of inflow)
Center-of-Mass det. time= 60.0 min (889.1 - 829.1)

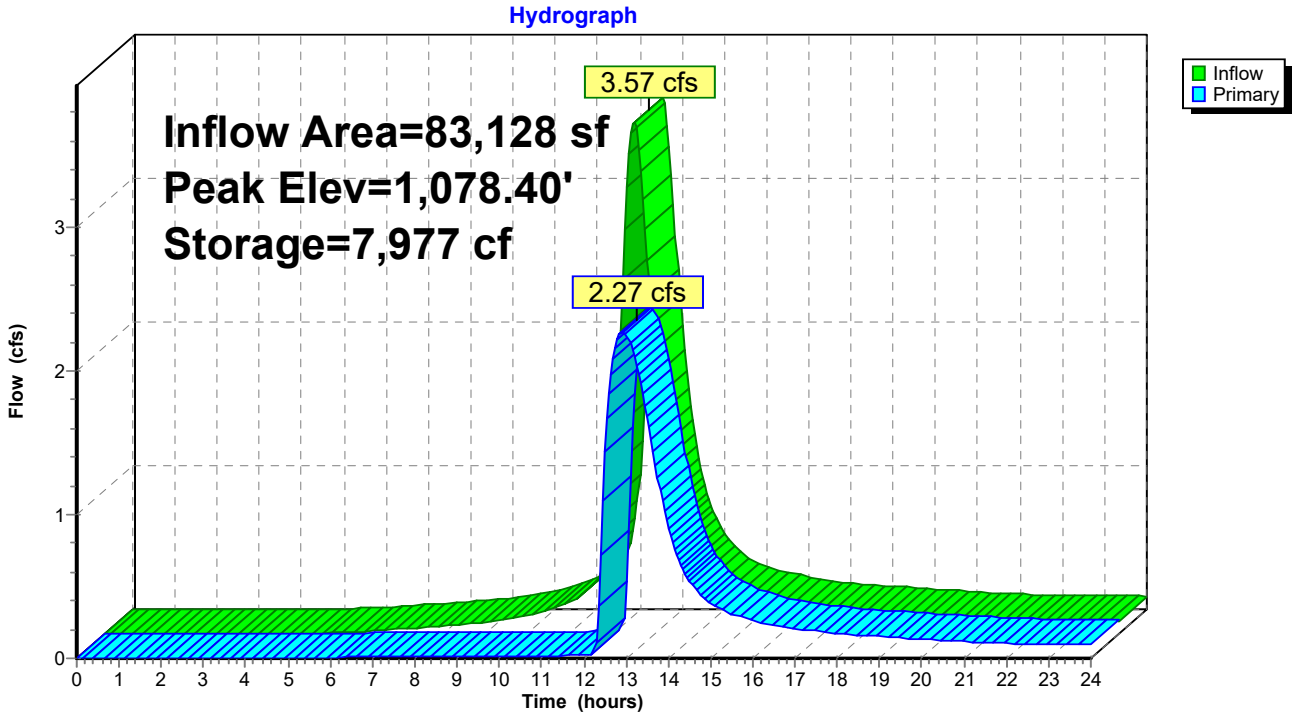
Volume	Invert	Avail.Storage	Storage Description
#1	1,075.70'	16,412 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,075.70	0	0	0
1,076.00	636	95	95
1,077.00	3,497	2,067	2,162
1,078.00	4,426	3,962	6,123
1,079.00	5,433	4,930	11,053
1,079.70	6,338	4,120	15,173
1,079.86	9,149	1,239	16,412

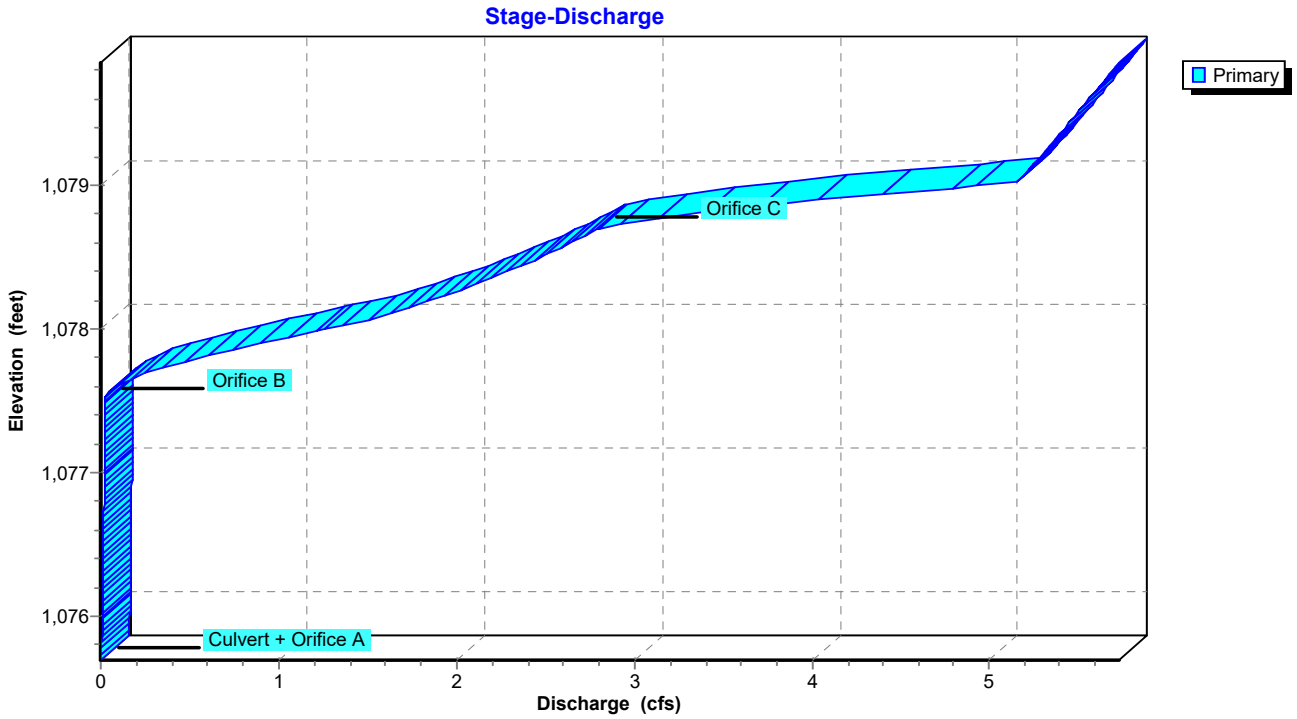
Device	Routing	Invert	Outlet Devices
#1	Primary	1,075.70'	**12.0" Round Culvert** L= 122.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,075.70' / 1,074.46' S= 0.0102 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	1,075.70'	**0.8" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,077.51'	**7.5" Vert. Orifice B X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	1,078.70'	**12.0" Horiz. Orifice C** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.27 cfs @ 12.92 hrs HW=1,078.40' TW=1,075.16' (Fixed TW Elev= 1,075.16')
└─**1=Culvert** (Passes 2.27 cfs of 4.68 cfs potential flow)
  ├─**2=Orifice A** (Orifice Controls 0.03 cfs @ 7.86 fps)
  ├─**3=Orifice B** (Orifice Controls 2.24 cfs @ 3.66 fps)
  └─**4=Orifice C** (Controls 0.00 cfs)

Pond 4P: Pond



Pond 4P: Pond



Summary for Subcatchment 1S: Proposed Drainage Area

[47] Hint: Peak is 112% of capacity of segment #4
[47] Hint: Peak is 133% of capacity of segment #5
[47] Hint: Peak is 163% of capacity of segment #6

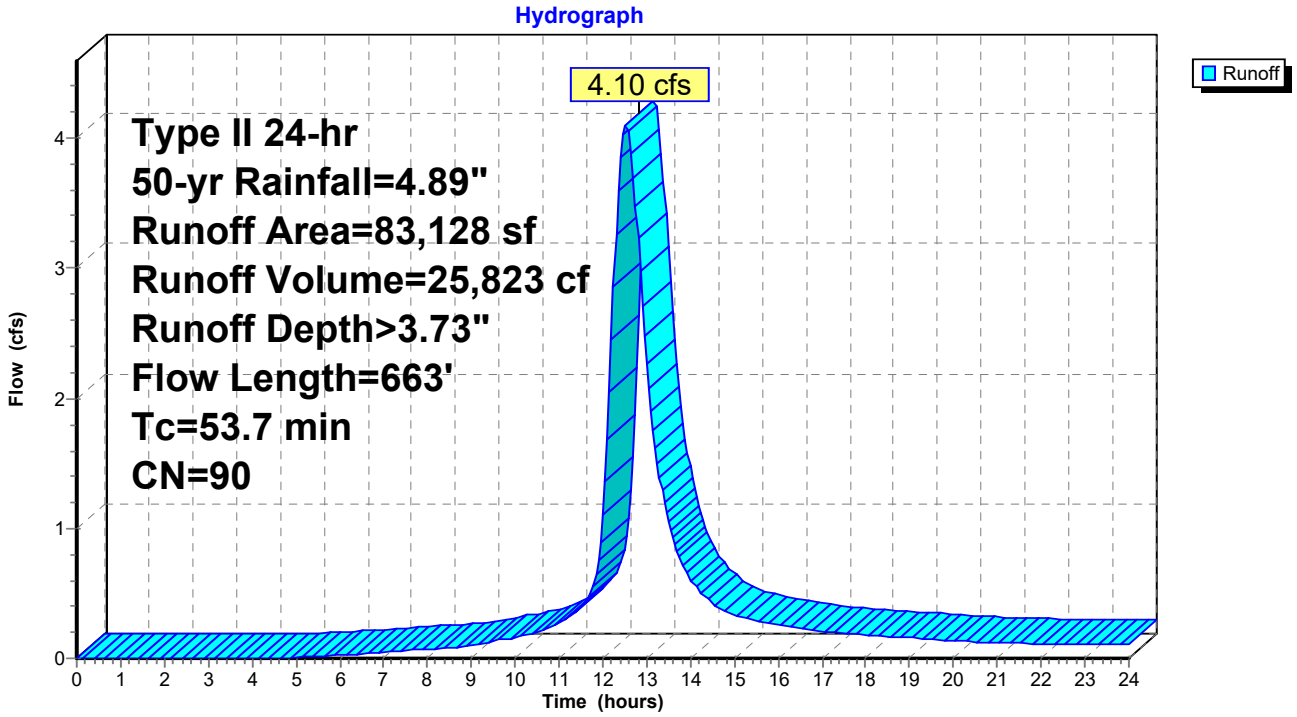
Runoff = 4.10 cfs @ 12.52 hrs, Volume= 25,823 cf, Depth> 3.73"
Routed to Pond 4P : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=4.89"

Area (sf)	CN	Description
47,377	98	Paved parking, HSG D
35,751	80	>75% Grass cover, Good, HSG D
83,128	90	Weighted Average
35,751		43.01% Pervious Area
47,377		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
2.6	133	0.0033	0.86		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.5	76	0.0150	2.49		**Shallow Concentrated Flow, Run #3** Paved Kv= 20.3 fps
0.2	42	0.0105	4.65	3.65	**Pipe Channel, Run #4** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.8	189	0.0075	3.93	3.09	**Pipe Channel, Run #5** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	123	0.0050	3.21	2.52	**Pipe Channel, Run #6** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
53.7	663	Total			

Subcatchment 1S: Proposed Drainage Area



Summary for Subcatchment 6S: Proposed Off-Site Drainage Area

[49] Hint: Tc<2dt may require smaller dt

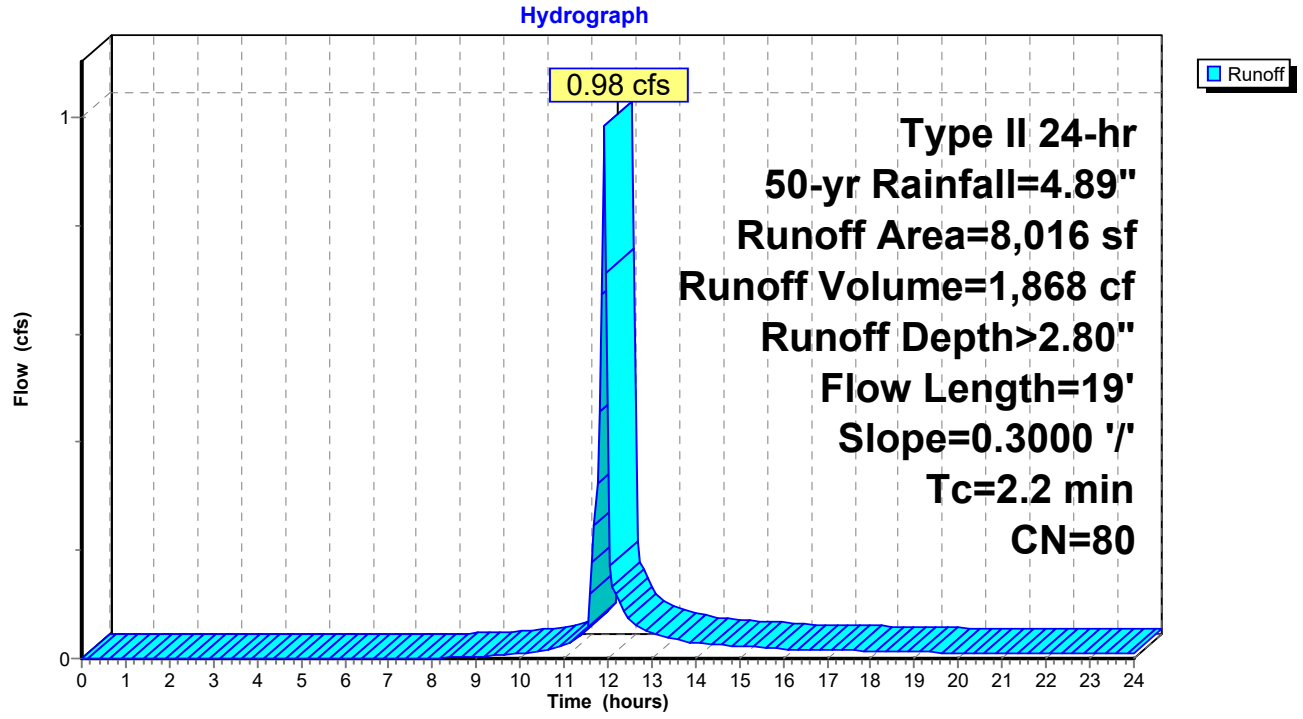
Runoff = 0.98 cfs @ 11.93 hrs, Volume= 1,868 cf, Depth> 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=4.89"

Area (sf)	CN	Description
8,016	80	>75% Grass cover, Good, HSG D
8,016		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	19	0.3000	0.15		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"

Subcatchment 6S: Proposed Off-Site Drainage Area



Summary for Pond 4P: Pond

Inflow Area = 83,128 sf, 56.99% Impervious, Inflow Depth > 3.73" for 50-yr event
Inflow = 4.10 cfs @ 12.52 hrs, Volume= 25,823 cf
Outflow = 2.61 cfs @ 12.92 hrs, Volume= 21,314 cf, Atten= 36%, Lag= 24.0 min
Primary = 2.61 cfs @ 12.92 hrs, Volume= 21,314 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,078.59' @ 12.92 hrs Surf.Area= 5,019 sf Storage= 8,902 cf

Plug-Flow detention time= 127.4 min calculated for 21,314 cf (83% of inflow)
Center-of-Mass det. time= 57.8 min (883.0 - 825.2)

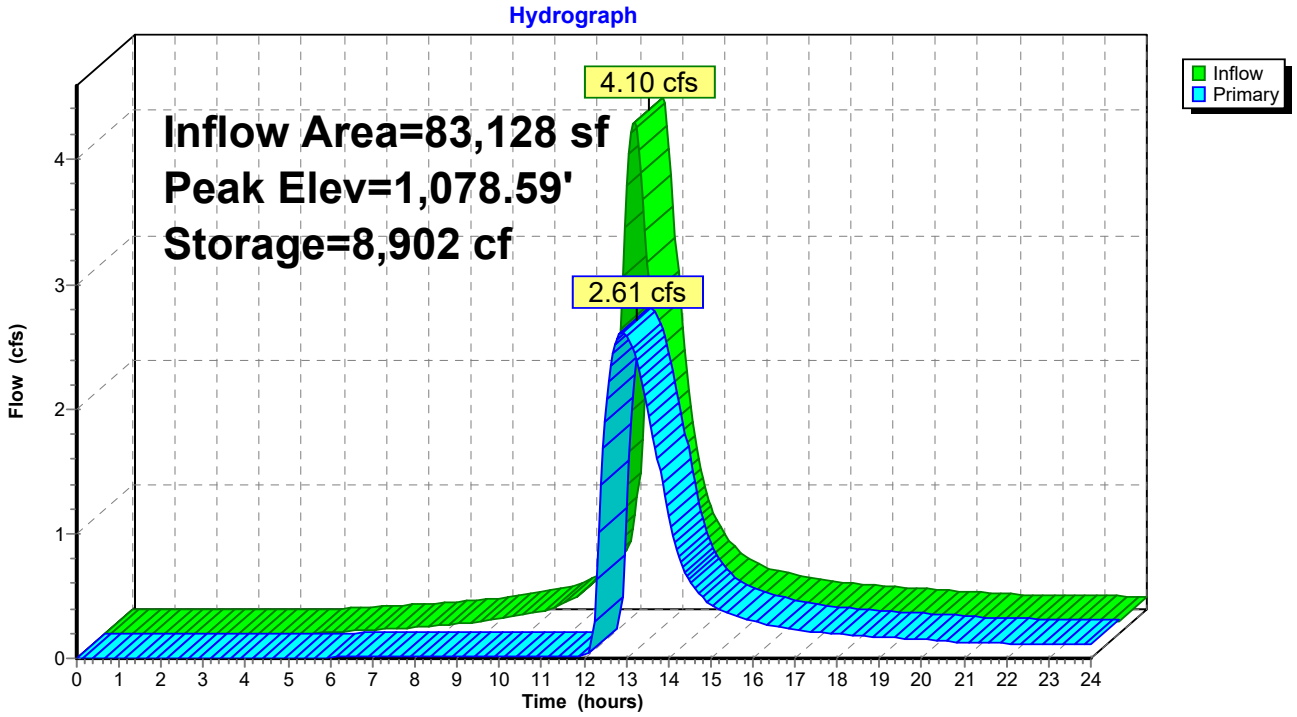
Volume	Invert	Avail.Storage	Storage Description
#1	1,075.70'	16,412 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,075.70	0	0	0
1,076.00	636	95	95
1,077.00	3,497	2,067	2,162
1,078.00	4,426	3,962	6,123
1,079.00	5,433	4,930	11,053
1,079.70	6,338	4,120	15,173
1,079.86	9,149	1,239	16,412

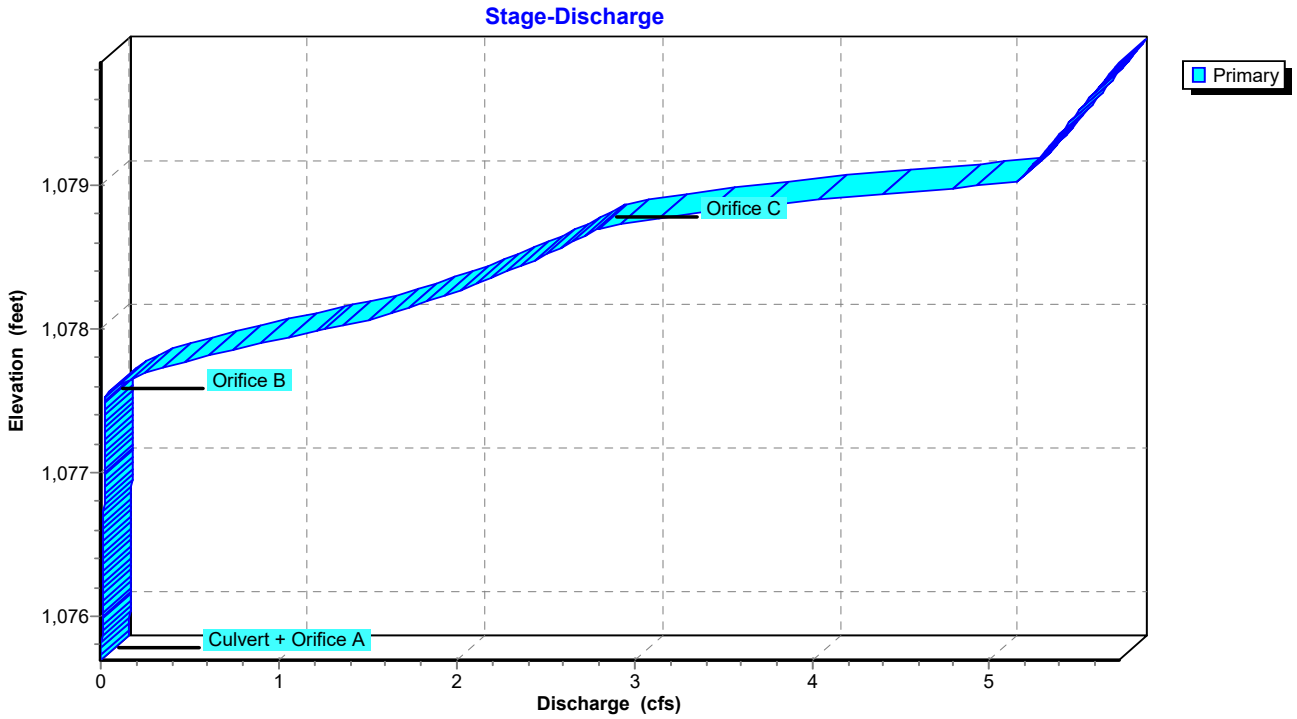
Device	Routing	Invert	Outlet Devices
#1	Primary	1,075.70'	**12.0" Round Culvert** L= 122.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,075.70' / 1,074.46' S= 0.0102 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	1,075.70'	**0.8" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,077.51'	**7.5" Vert. Orifice B X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	1,078.70'	**12.0" Horiz. Orifice C** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.61 cfs @ 12.92 hrs HW=1,078.59' TW=1,075.16' (Fixed TW Elev= 1,075.16')
└─**1=Culvert** (Passes 2.61 cfs of 4.83 cfs potential flow)
  ├─**2=Orifice A** (Orifice Controls 0.03 cfs @ 8.13 fps)
  ├─**3=Orifice B** (Orifice Controls 2.58 cfs @ 4.21 fps)
  └─**4=Orifice C** (Controls 0.00 cfs)

Pond 4P: Pond



Pond 4P: Pond



Summary for Subcatchment 1S: Proposed Drainage Area

[47] Hint: Peak is 127% of capacity of segment #4
[47] Hint: Peak is 151% of capacity of segment #5
[47] Hint: Peak is 185% of capacity of segment #6

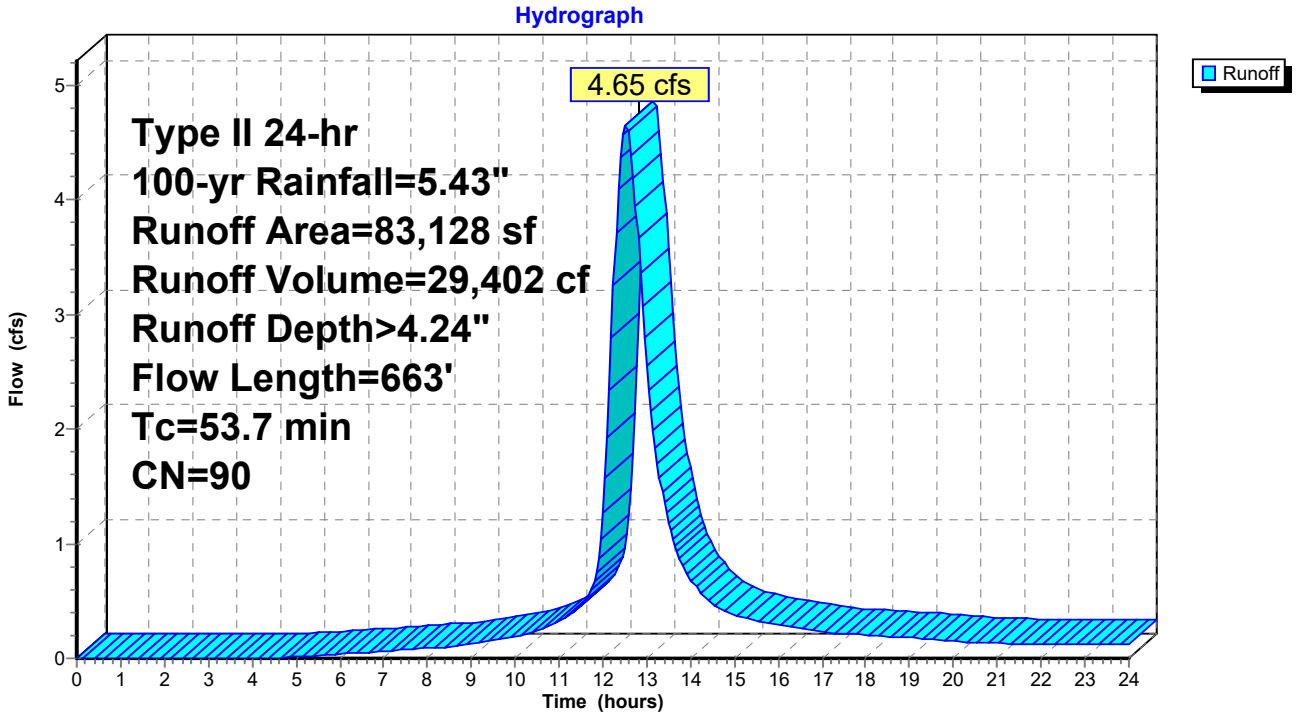
Runoff = 4.65 cfs @ 12.52 hrs, Volume= 29,402 cf, Depth> 4.24"
Routed to Pond 4P : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.43"

Area (sf)	CN	Description
47,377	98	Paved parking, HSG D
35,751	80	>75% Grass cover, Good, HSG D
83,128	90	Weighted Average
35,751		43.01% Pervious Area
47,377		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
2.6	133	0.0033	0.86		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.5	76	0.0150	2.49		**Shallow Concentrated Flow, Run #3** Paved Kv= 20.3 fps
0.2	42	0.0105	4.65	3.65	**Pipe Channel, Run #4** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.8	189	0.0075	3.93	3.09	**Pipe Channel, Run #5** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	123	0.0050	3.21	2.52	**Pipe Channel, Run #6** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
53.7	663	Total			

Subcatchment 1S: Proposed Drainage Area



Summary for Subcatchment 6S: Proposed Off-Site Drainage Area

[49] Hint: Tc<2dt may require smaller dt

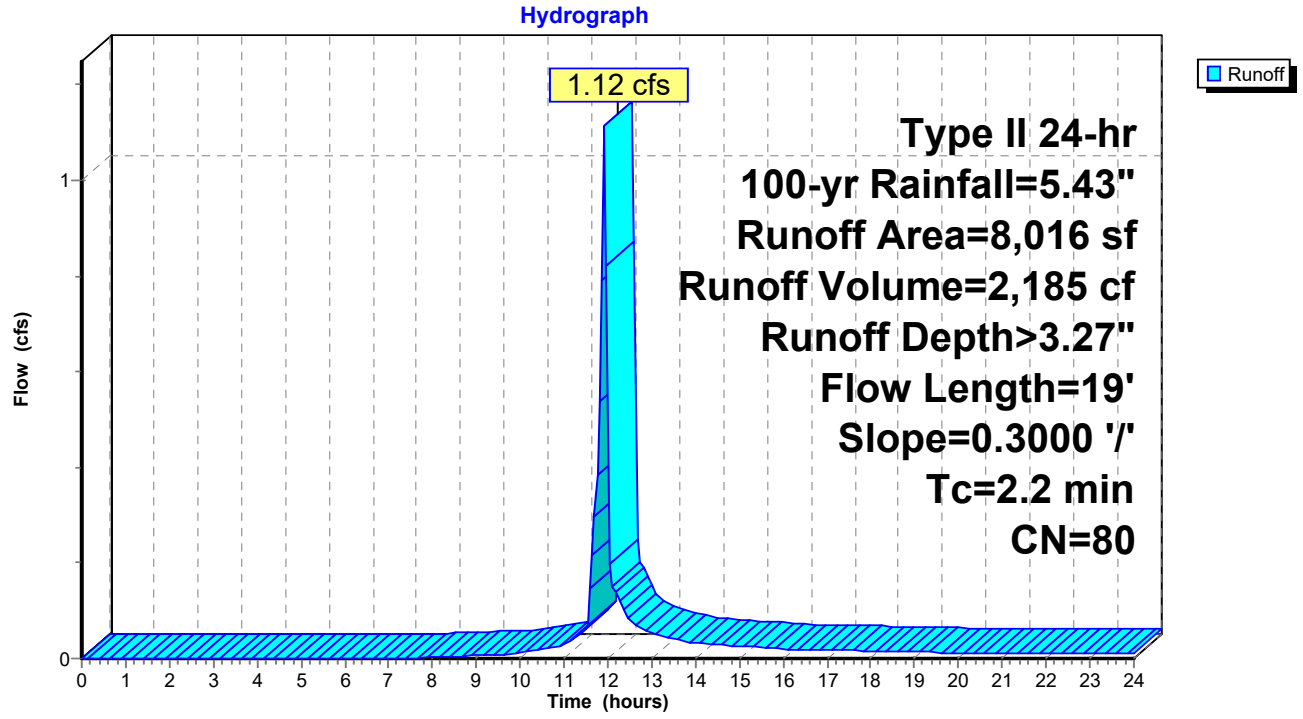
Runoff = 1.12 cfs @ 11.92 hrs, Volume= 2,185 cf, Depth> 3.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.43"

Area (sf)	CN	Description
8,016	80	>75% Grass cover, Good, HSG D
8,016		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	19	0.3000	0.15		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"

Subcatchment 6S: Proposed Off-Site Drainage Area



Summary for Pond 4P: Pond

Inflow Area = 83,128 sf, 56.99% Impervious, Inflow Depth > 4.24" for 100-yr event
Inflow = 4.65 cfs @ 12.52 hrs, Volume= 29,402 cf
Outflow = 3.09 cfs @ 12.90 hrs, Volume= 24,862 cf, Atten= 34%, Lag= 22.7 min
Primary = 3.09 cfs @ 12.90 hrs, Volume= 24,862 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,078.77' @ 12.90 hrs Surf.Area= 5,199 sf Storage= 9,820 cf

Plug-Flow detention time= 120.4 min calculated for 24,810 cf (84% of inflow)
Center-of-Mass det. time= 56.6 min (878.3 - 821.7)

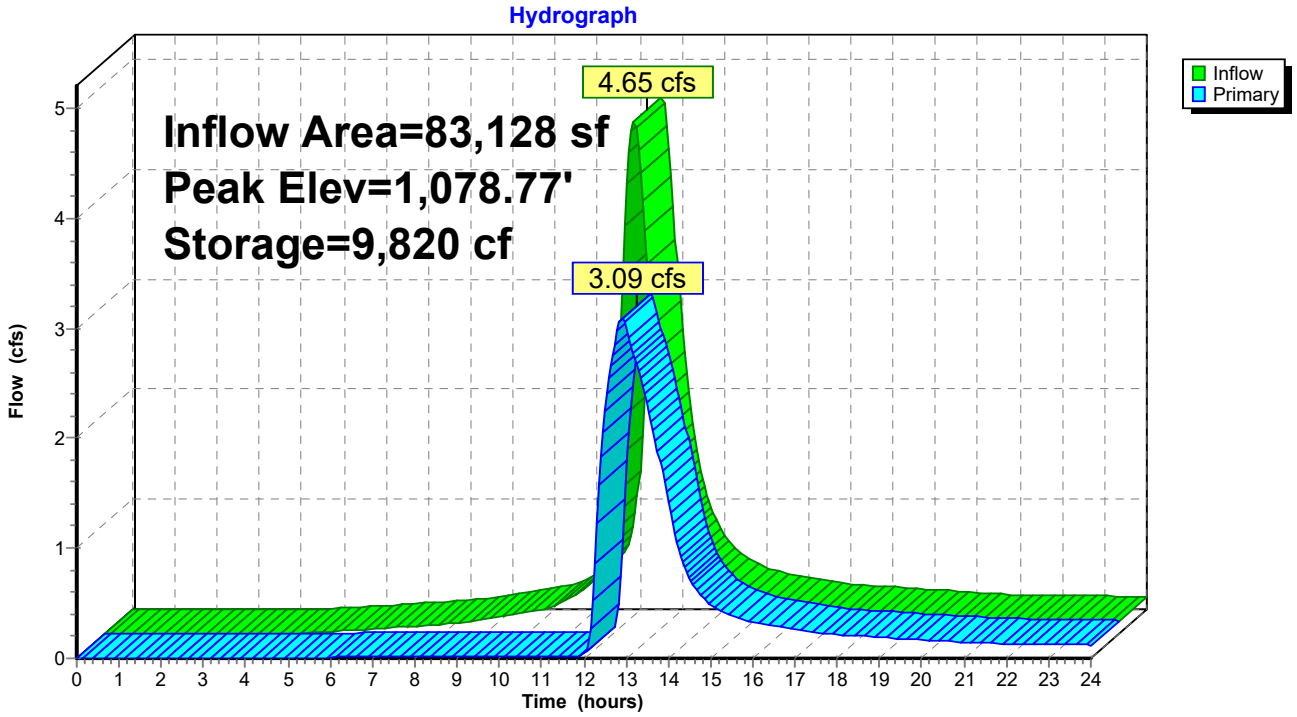
Volume	Invert	Avail.Storage	Storage Description
#1	1,075.70'	16,412 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,075.70	0	0	0
1,076.00	636	95	95
1,077.00	3,497	2,067	2,162
1,078.00	4,426	3,962	6,123
1,079.00	5,433	4,930	11,053
1,079.70	6,338	4,120	15,173
1,079.86	9,149	1,239	16,412

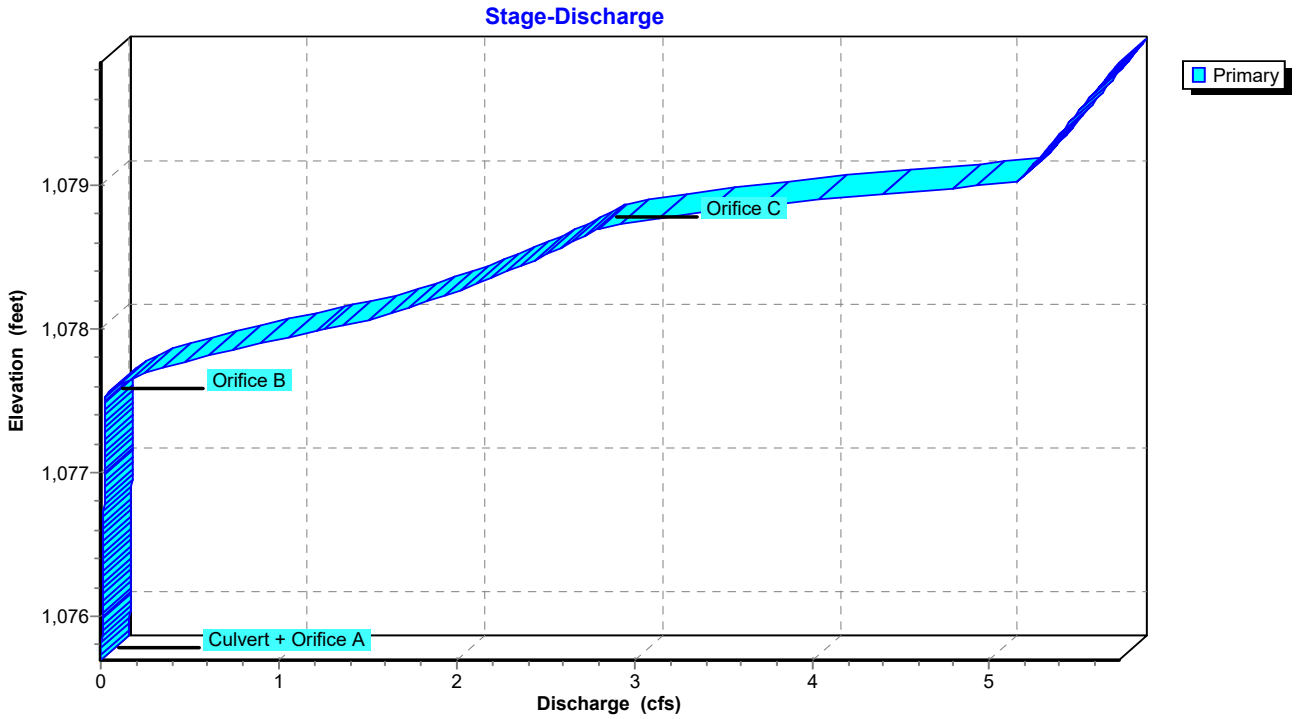
Device	Routing	Invert	Outlet Devices
#1	Primary	1,075.70'	**12.0" Round Culvert** L= 122.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,075.70' / 1,074.46' S= 0.0102 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	1,075.70'	**0.8" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,077.51'	**7.5" Vert. Orifice B X 2.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	1,078.70'	**12.0" Horiz. Orifice C** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.08 cfs @ 12.90 hrs HW=1,078.77' TW=1,075.16' (Fixed TW Elev= 1,075.16')
└─**1=Culvert** (Passes 3.08 cfs of 4.97 cfs potential flow)
  ├─**2=Orifice A** (Orifice Controls 0.03 cfs @ 8.39 fps)
  ├─**3=Orifice B** (Orifice Controls 2.87 cfs @ 4.68 fps)
  └─**4=Orifice C** (Weir Controls 0.18 cfs @ 0.85 fps)

Pond 4P: Pond



Pond 4P: Pond



SECTION 9

OVERFLOW SPILLWAY CALCULATIONS

Summary for Subcatchment 1S: Proposed Drainage Area

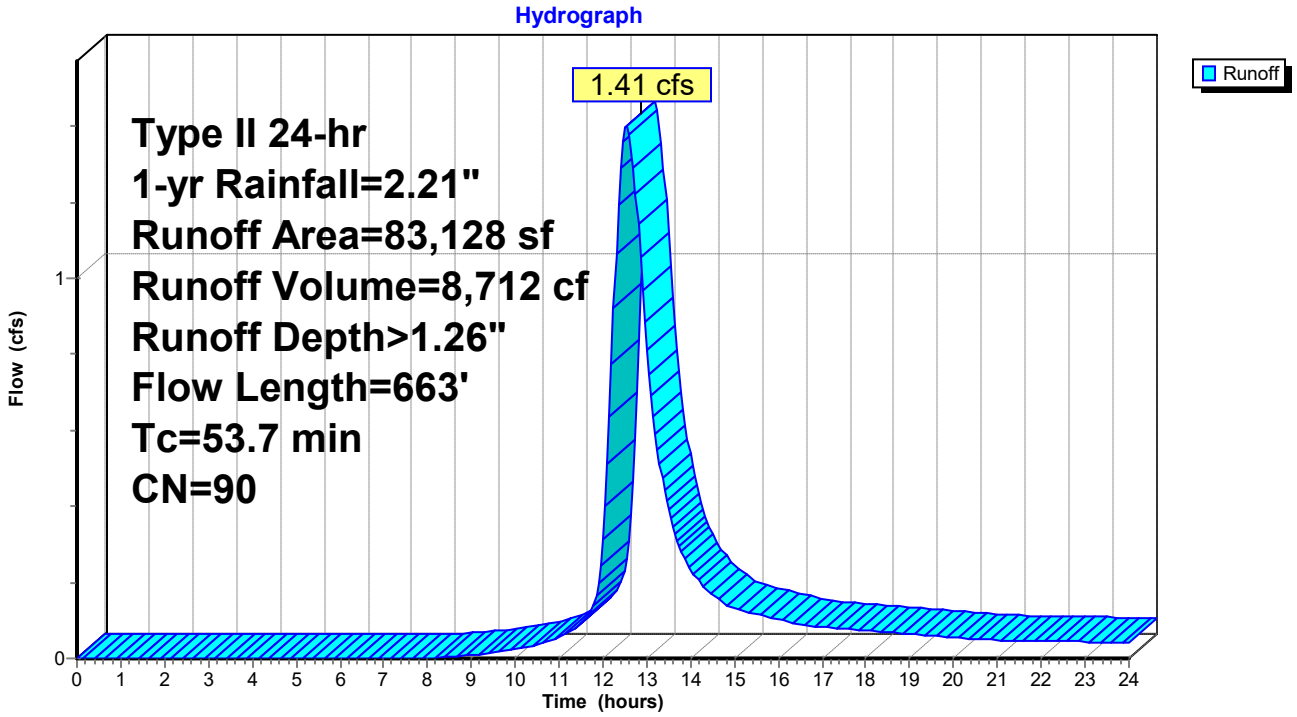
Runoff = 1.41 cfs @ 12.54 hrs, Volume= 8,712 cf, Depth> 1.26"
Routed to Pond 3P : Pond - Emergency Spillway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.21"

Area (sf)	CN	Description
47,377	98	Paved parking, HSG D
35,751	80	>75% Grass cover, Good, HSG D
83,128	90	Weighted Average
35,751		43.01% Pervious Area
47,377		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
2.6	133	0.0033	0.86		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.5	76	0.0150	2.49		**Shallow Concentrated Flow, Run #3** Paved Kv= 20.3 fps
0.2	42	0.0105	4.65	3.65	**Pipe Channel, Run #4** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.8	189	0.0075	3.93	3.09	**Pipe Channel, Run #5** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	123	0.0050	3.21	2.52	**Pipe Channel, Run #6** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
53.7	663	Total			

Subcatchment 1S: Proposed Drainage Area



Summary for Subcatchment 6S: Proposed Off-Site Drainage Area

[49] Hint: Tc<2dt may require smaller dt

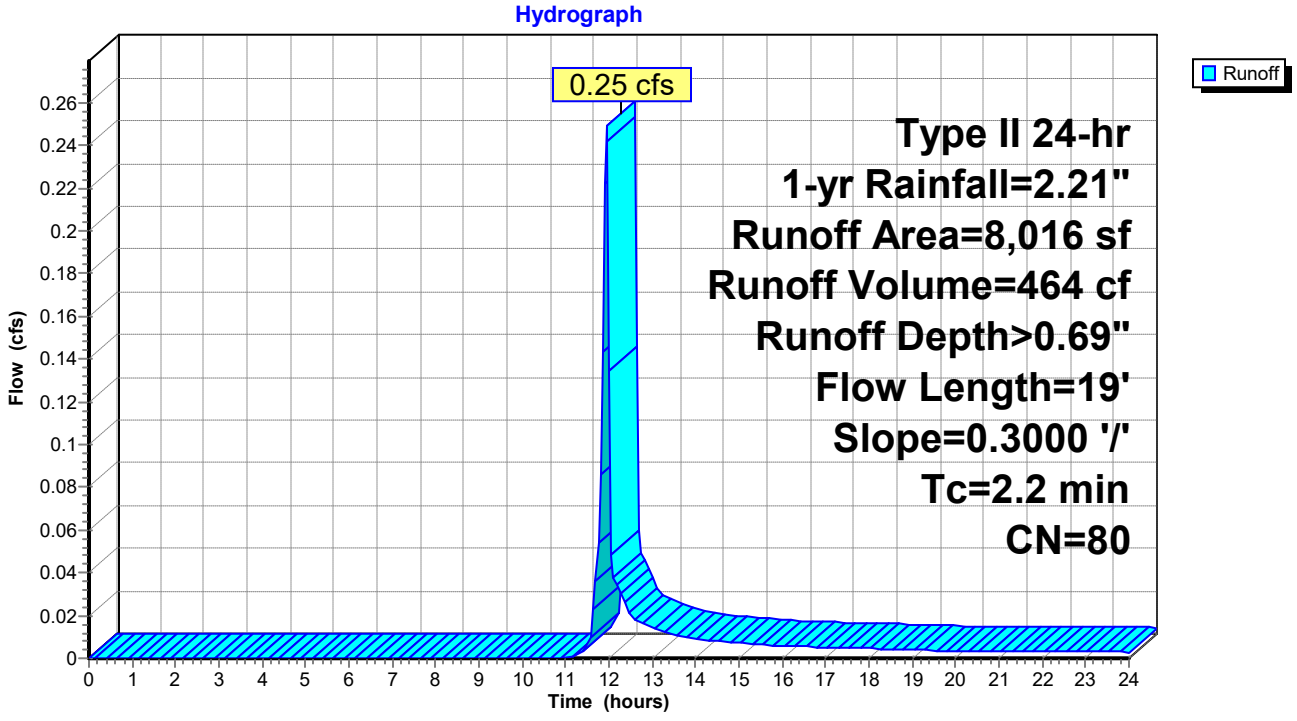
Runoff = 0.25 cfs @ 11.93 hrs, Volume= 464 cf, Depth> 0.69"
Routed to Pond 3P : Pond - Emergency Spillway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.21"

Area (sf)	CN	Description
8,016	80	>75% Grass cover, Good, HSG D
8,016		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	19	0.3000	0.15		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"

Subcatchment 6S: Proposed Off-Site Drainage Area



Summary for Pond 3P: Pond - Emergency Spillway

Inflow Area = 91,144 sf, 51.98% Impervious, Inflow Depth > 1.21" for 1-yr event
Inflow = 1.42 cfs @ 12.54 hrs, Volume= 9,176 cf
Outflow = 0.05 cfs @ 20.97 hrs, Volume= 692 cf, Atten= 96%, Lag= 505.8 min
Primary = 0.05 cfs @ 20.97 hrs, Volume= 692 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,078.84' @ 20.97 hrs Surf.Area= 4,410 sf Storage= 8,488 cf

Plug-Flow detention time= 649.0 min calculated for 692 cf (8% of inflow)
Center-of-Mass det. time= 465.8 min (1,320.7 - 854.8)

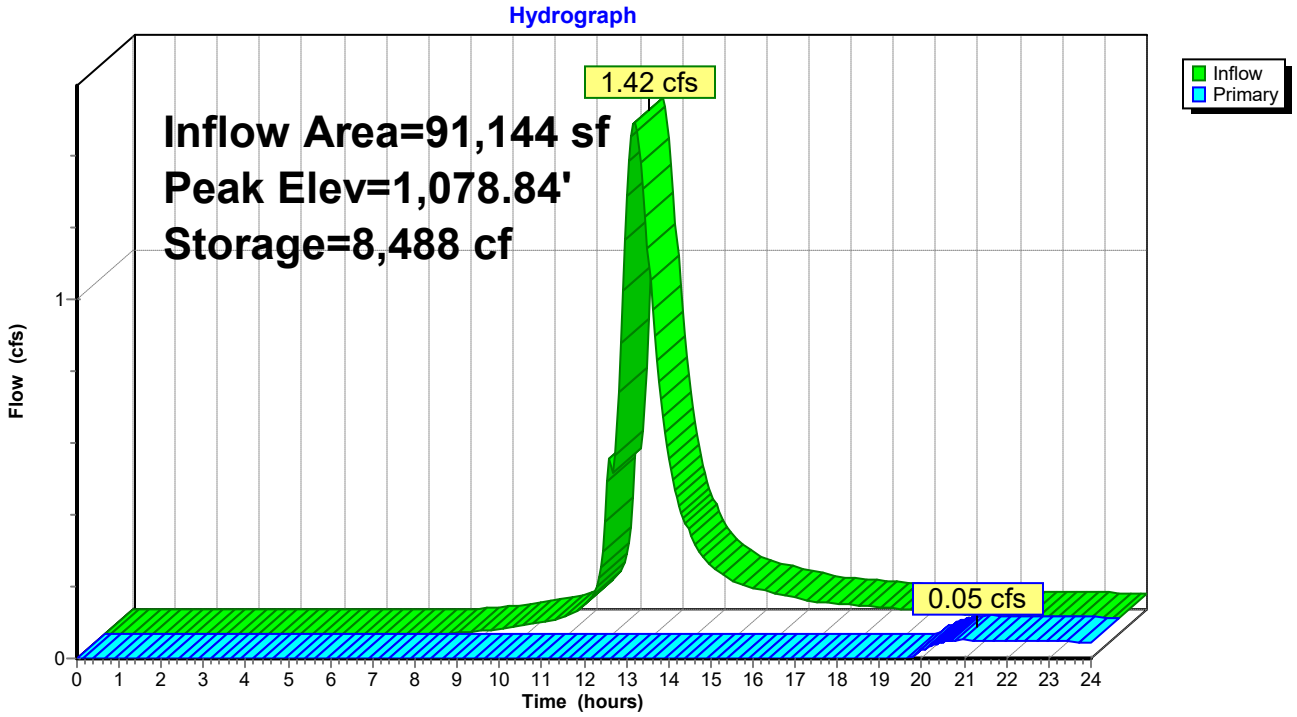
Volume	Invert	Avail.Storage	Storage Description
#1	1,075.80'	15,083 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,075.80	0	0	0
1,076.00	641	64	64
1,077.00	2,809	1,725	1,789
1,078.00	3,750	3,280	5,069
1,079.00	4,538	4,144	9,213
1,079.96	7,692	5,870	15,083

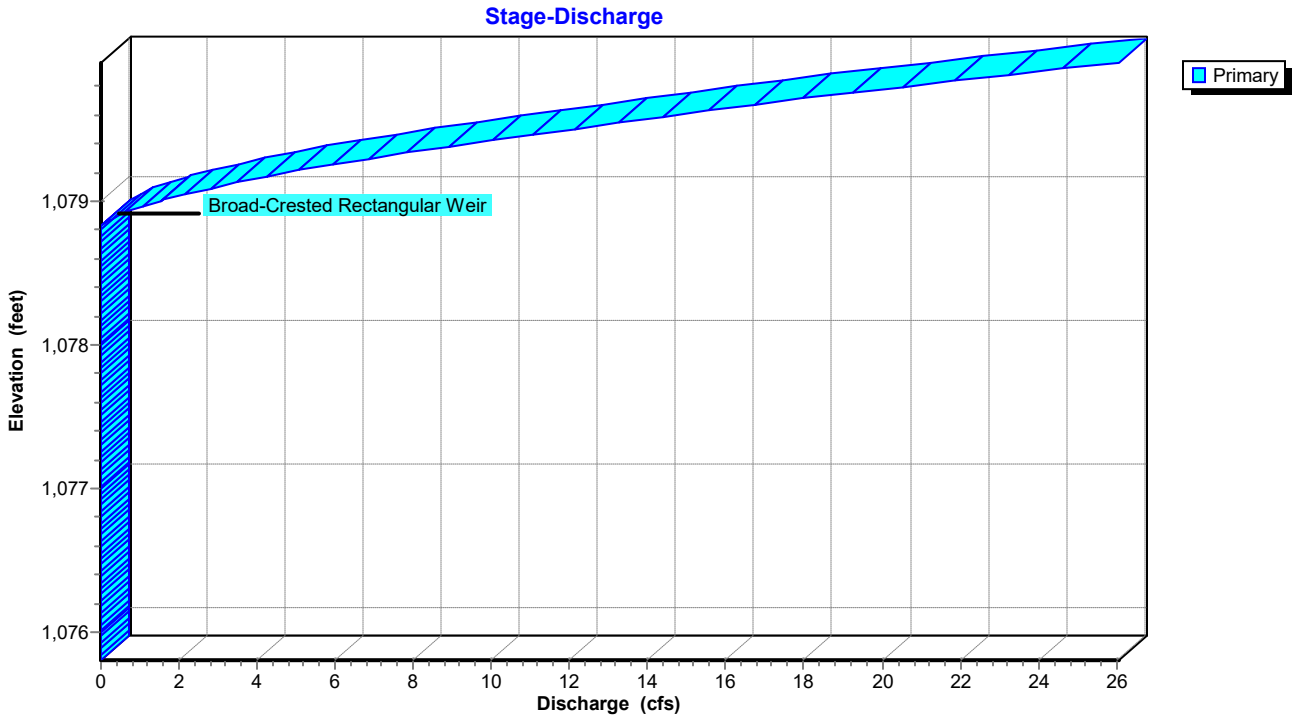
Device	Routing	Invert	Outlet Devices
#1	Primary	1,078.82'	**8.0' long x 10.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.52 2.58 2.70 2.68 2.67 2.68 2.67 2.64

Primary OutFlow Max=0.05 cfs @ 20.97 hrs HW=1,078.84' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.05 cfs @ 0.34 fps)

Pond 3P: Pond - Emergency Spillway



Pond 3P: Pond - Emergency Spillway



Summary for Subcatchment 1S: Proposed Drainage Area

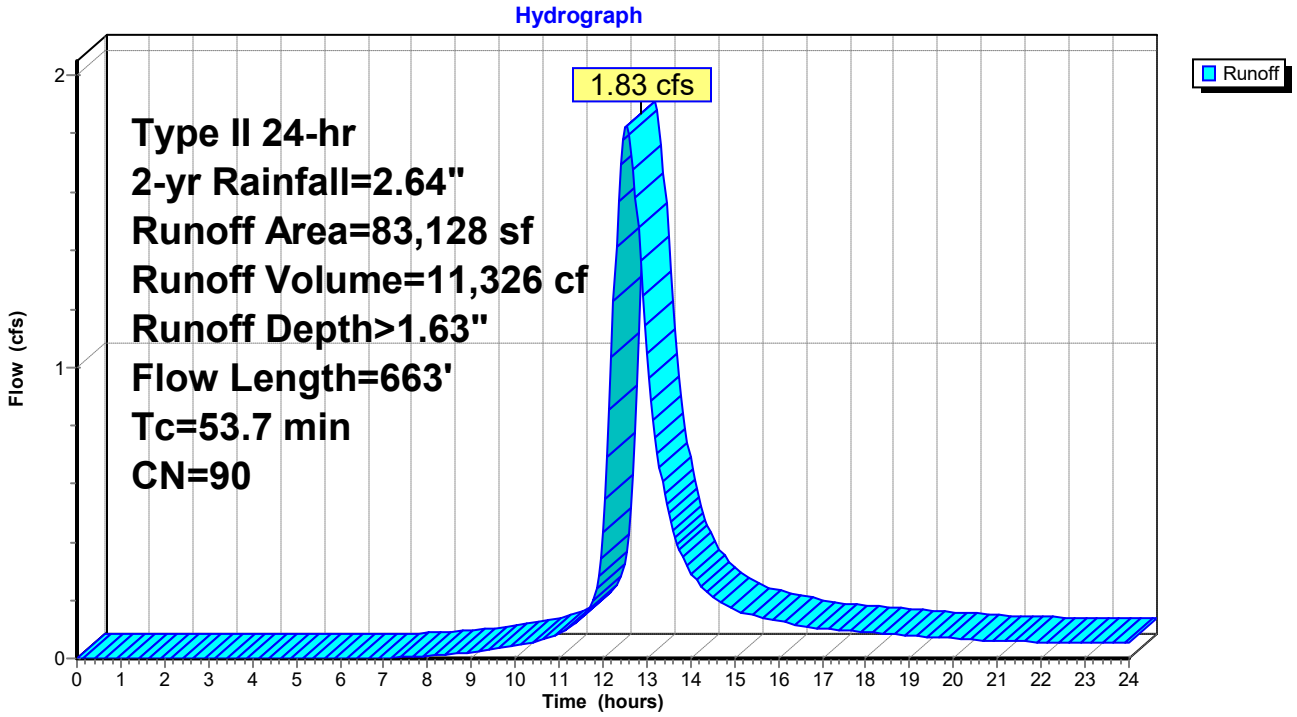
Runoff = 1.83 cfs @ 12.54 hrs, Volume= 11,326 cf, Depth> 1.63"
Routed to Pond 3P : Pond - Emergency Spillway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.64"

Area (sf)	CN	Description
47,377	98	Paved parking, HSG D
35,751	80	>75% Grass cover, Good, HSG D
83,128	90	Weighted Average
35,751		43.01% Pervious Area
47,377		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
2.6	133	0.0033	0.86		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.5	76	0.0150	2.49		**Shallow Concentrated Flow, Run #3** Paved Kv= 20.3 fps
0.2	42	0.0105	4.65	3.65	**Pipe Channel, Run #4** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.8	189	0.0075	3.93	3.09	**Pipe Channel, Run #5** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	123	0.0050	3.21	2.52	**Pipe Channel, Run #6** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
53.7	663	Total			

Subcatchment 1S: Proposed Drainage Area



Summary for Subcatchment 6S: Proposed Off-Site Drainage Area

[49] Hint: Tc<2dt may require smaller dt

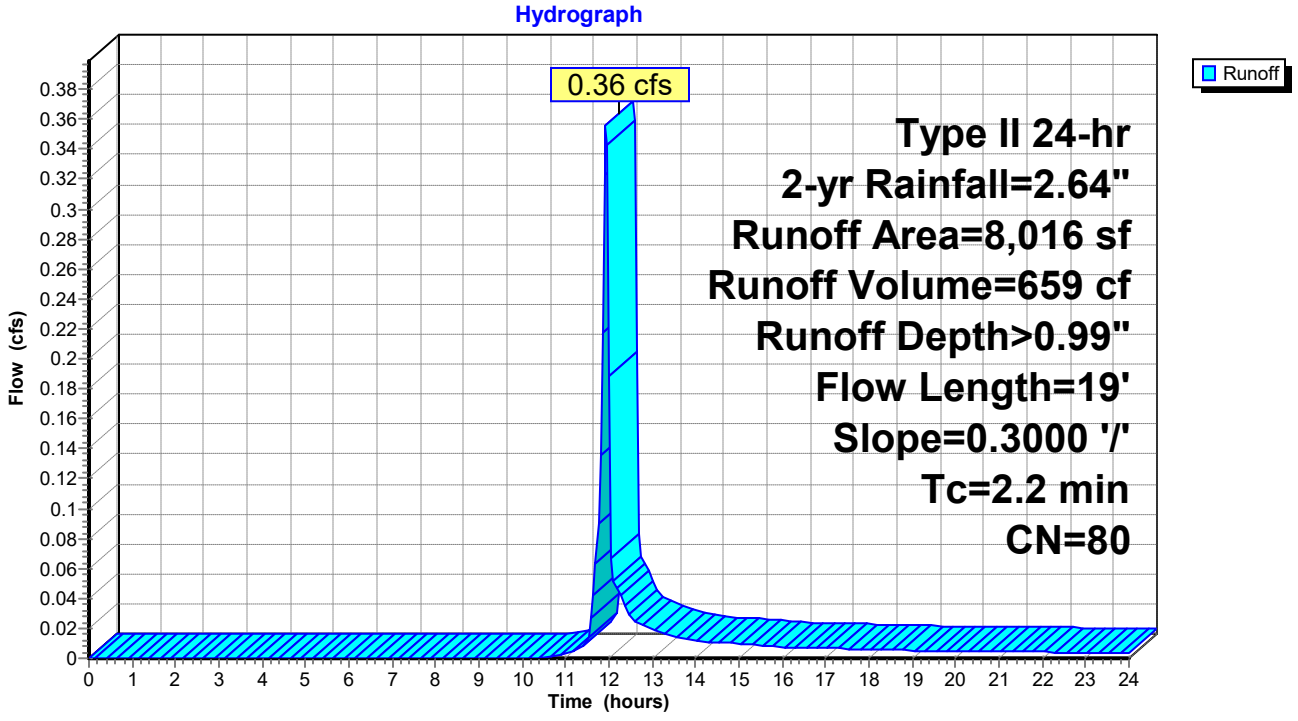
Runoff = 0.36 cfs @ 11.93 hrs, Volume= 659 cf, Depth> 0.99"
Routed to Pond 3P : Pond - Emergency Spillway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.64"

Area (sf)	CN	Description
8,016	80	>75% Grass cover, Good, HSG D
8,016		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	19	0.3000	0.15		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"

Subcatchment 6S: Proposed Off-Site Drainage Area



Summary for Pond 3P: Pond - Emergency Spillway

Inflow Area = 91,144 sf, 51.98% Impervious, Inflow Depth > 1.58" for 2-yr event
Inflow = 1.86 cfs @ 12.53 hrs, Volume= 11,985 cf
Outflow = 0.20 cfs @ 14.65 hrs, Volume= 3,493 cf, Atten= 89%, Lag= 127.2 min
Primary = 0.20 cfs @ 14.65 hrs, Volume= 3,493 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,078.86' @ 14.65 hrs Surf.Area= 4,431 sf Storage= 8,604 cf

Plug-Flow detention time= 366.3 min calculated for 3,493 cf (29% of inflow)
Center-of-Mass det. time= 232.2 min (1,079.7 - 847.5)

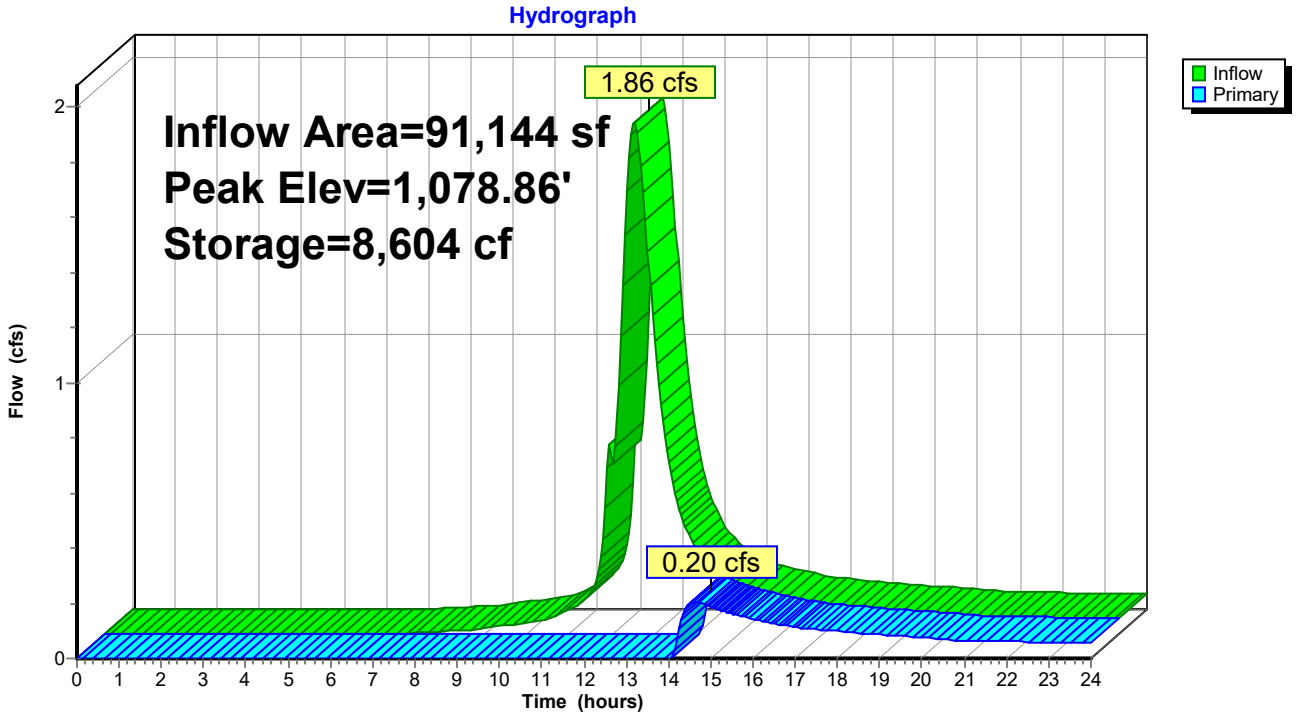
Volume	Invert	Avail.Storage	Storage Description
#1	1,075.80'	15,083 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,075.80	0	0	0
1,076.00	641	64	64
1,077.00	2,809	1,725	1,789
1,078.00	3,750	3,280	5,069
1,079.00	4,538	4,144	9,213
1,079.96	7,692	5,870	15,083

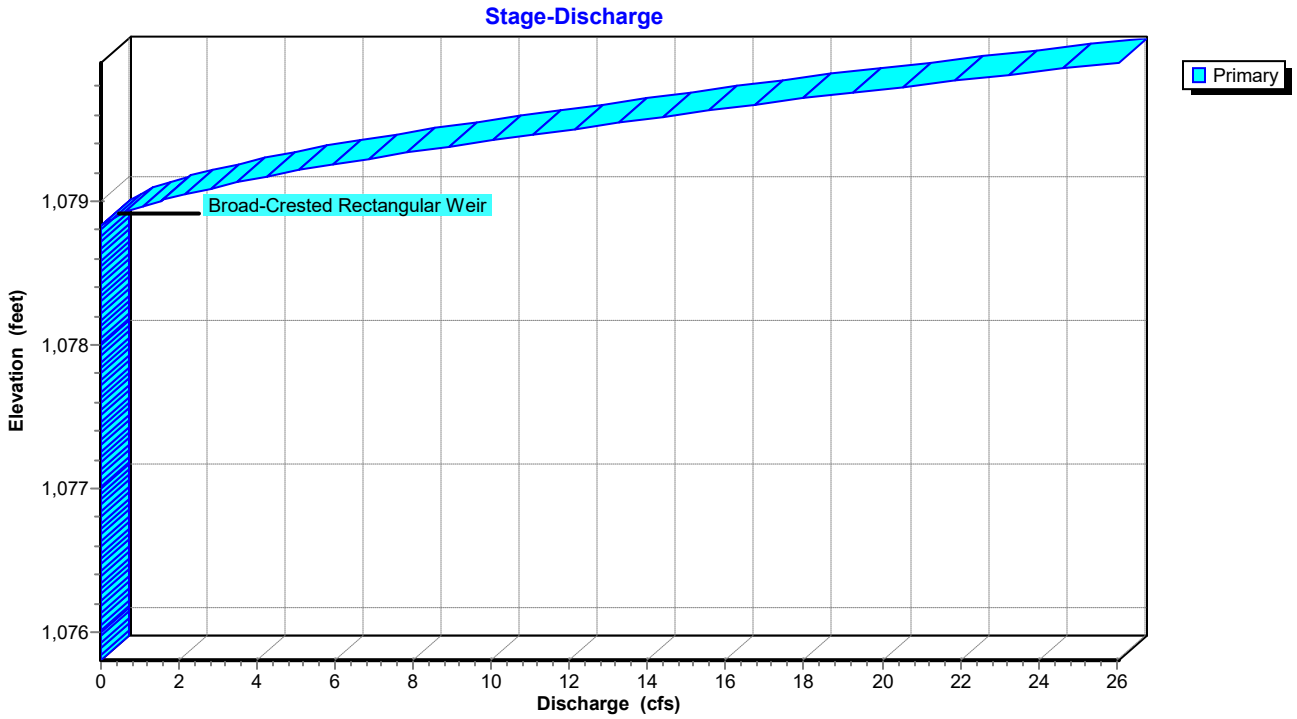
Device	Routing	Invert	Outlet Devices
#1	Primary	1,078.82'	**8.0' long x 10.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.52 2.58 2.70 2.68 2.67 2.68 2.67 2.64

Primary OutFlow Max=0.19 cfs @ 14.65 hrs HW=1,078.86' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.19 cfs @ 0.53 fps)

Pond 3P: Pond - Emergency Spillway



Pond 3P: Pond - Emergency Spillway



Summary for Subcatchment 1S: Proposed Drainage Area

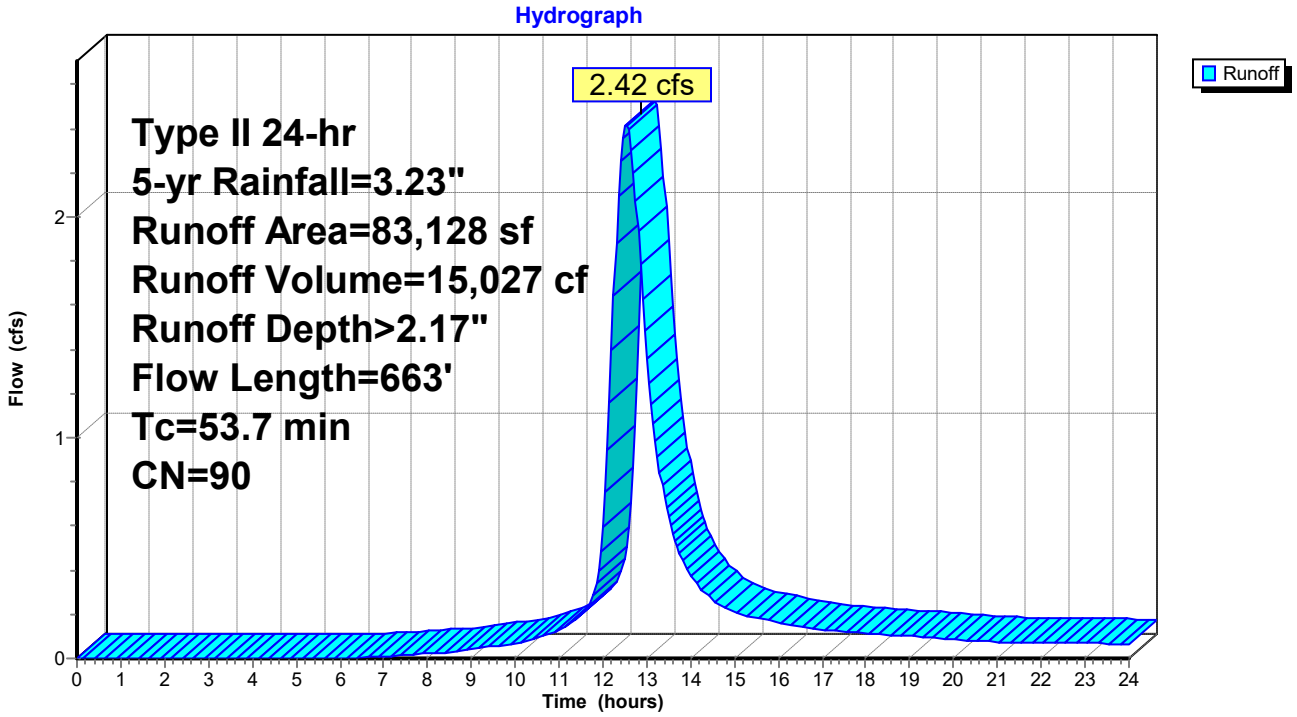
Runoff = 2.42 cfs @ 12.53 hrs, Volume= 15,027 cf, Depth> 2.17"
Routed to Pond 3P : Pond - Emergency Spillway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.23"

Area (sf)	CN	Description
47,377	98	Paved parking, HSG D
35,751	80	>75% Grass cover, Good, HSG D
83,128	90	Weighted Average
35,751		43.01% Pervious Area
47,377		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
2.6	133	0.0033	0.86		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.5	76	0.0150	2.49		**Shallow Concentrated Flow, Run #3** Paved Kv= 20.3 fps
0.2	42	0.0105	4.65	3.65	**Pipe Channel, Run #4** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.8	189	0.0075	3.93	3.09	**Pipe Channel, Run #5** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	123	0.0050	3.21	2.52	**Pipe Channel, Run #6** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
53.7	663	Total			

Subcatchment 1S: Proposed Drainage Area



Summary for Subcatchment 6S: Proposed Off-Site Drainage Area

[49] Hint: Tc<2dt may require smaller dt

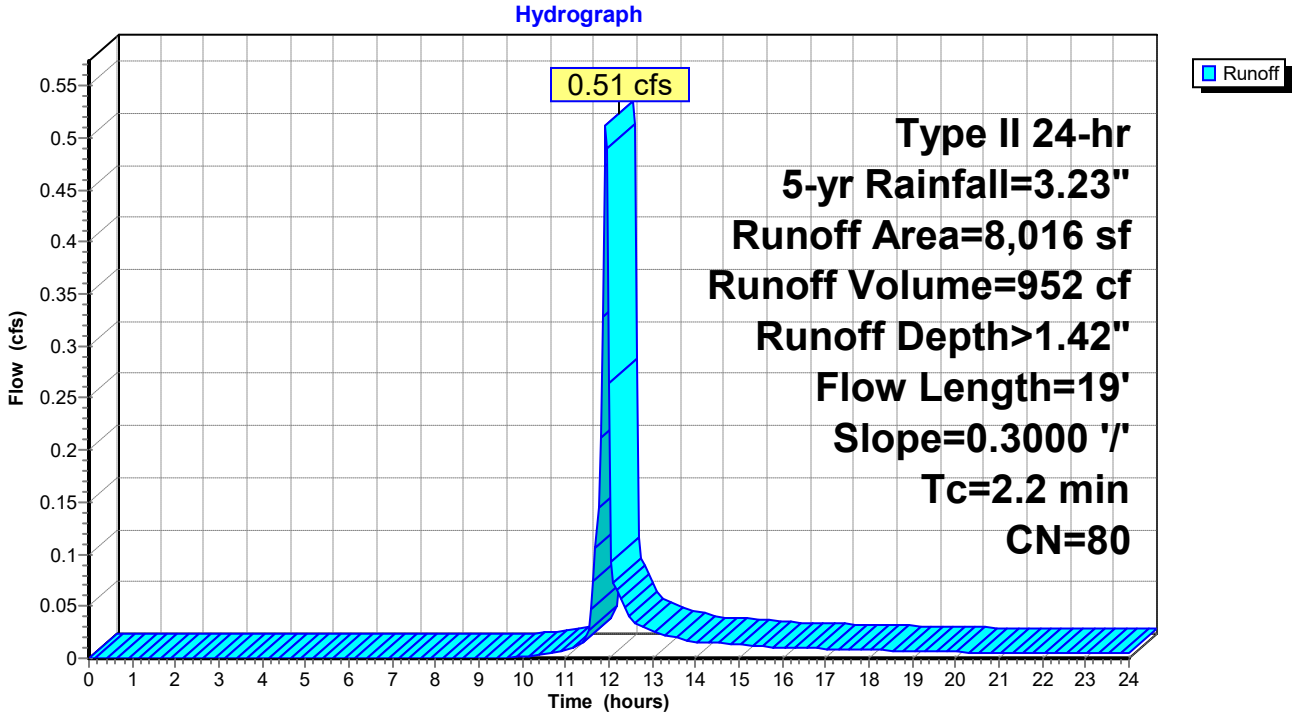
Runoff = 0.51 cfs @ 11.93 hrs, Volume= 952 cf, Depth> 1.42"
Routed to Pond 3P : Pond - Emergency Spillway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.23"

Area (sf)	CN	Description
8,016	80	>75% Grass cover, Good, HSG D
8,016		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	19	0.3000	0.15		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"

Subcatchment 6S: Proposed Off-Site Drainage Area



Summary for Pond 3P: Pond - Emergency Spillway

Inflow Area = 91,144 sf, 51.98% Impervious, Inflow Depth > 2.10" for 5-yr event
Inflow = 2.46 cfs @ 12.53 hrs, Volume= 15,979 cf
Outflow = 0.95 cfs @ 13.24 hrs, Volume= 7,476 cf, Atten= 61%, Lag= 42.9 min
Primary = 0.95 cfs @ 13.24 hrs, Volume= 7,476 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,078.95' @ 13.24 hrs Surf.Area= 4,499 sf Storage= 8,987 cf

Plug-Flow detention time= 247.1 min calculated for 7,460 cf (47% of inflow)
Center-of-Mass det. time= 132.2 min (971.8 - 839.6)

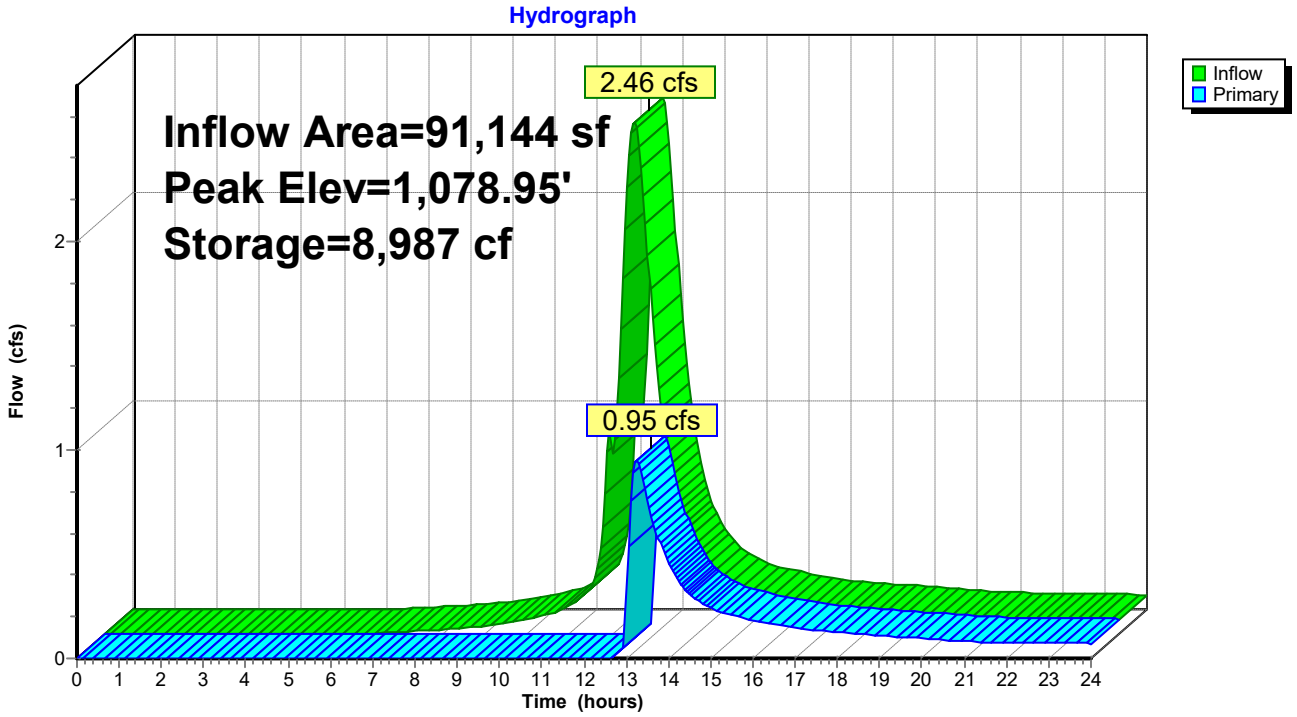
Volume	Invert	Avail.Storage	Storage Description
#1	1,075.80'	15,083 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,075.80	0	0	0
1,076.00	641	64	64
1,077.00	2,809	1,725	1,789
1,078.00	3,750	3,280	5,069
1,079.00	4,538	4,144	9,213
1,079.96	7,692	5,870	15,083

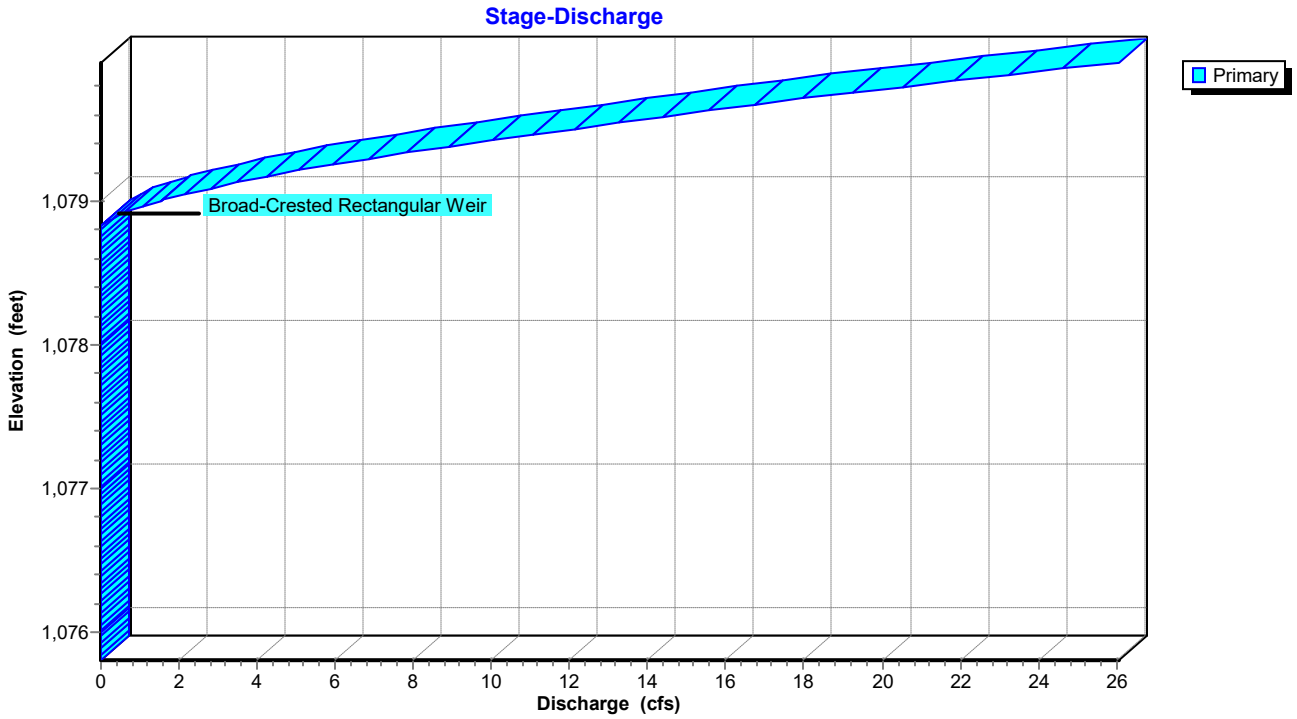
Device	Routing	Invert	Outlet Devices
#1	Primary	1,078.82'	**8.0' long x 10.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.52 2.58 2.70 2.68 2.67 2.68 2.67 2.64

Primary OutFlow Max=0.94 cfs @ 13.24 hrs HW=1,078.95' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.94 cfs @ 0.91 fps)

Pond 3P: Pond - Emergency Spillway



Pond 3P: Pond - Emergency Spillway



Summary for Subcatchment 1S: Proposed Drainage Area

[47] Hint: Peak is 115% of capacity of segment #6

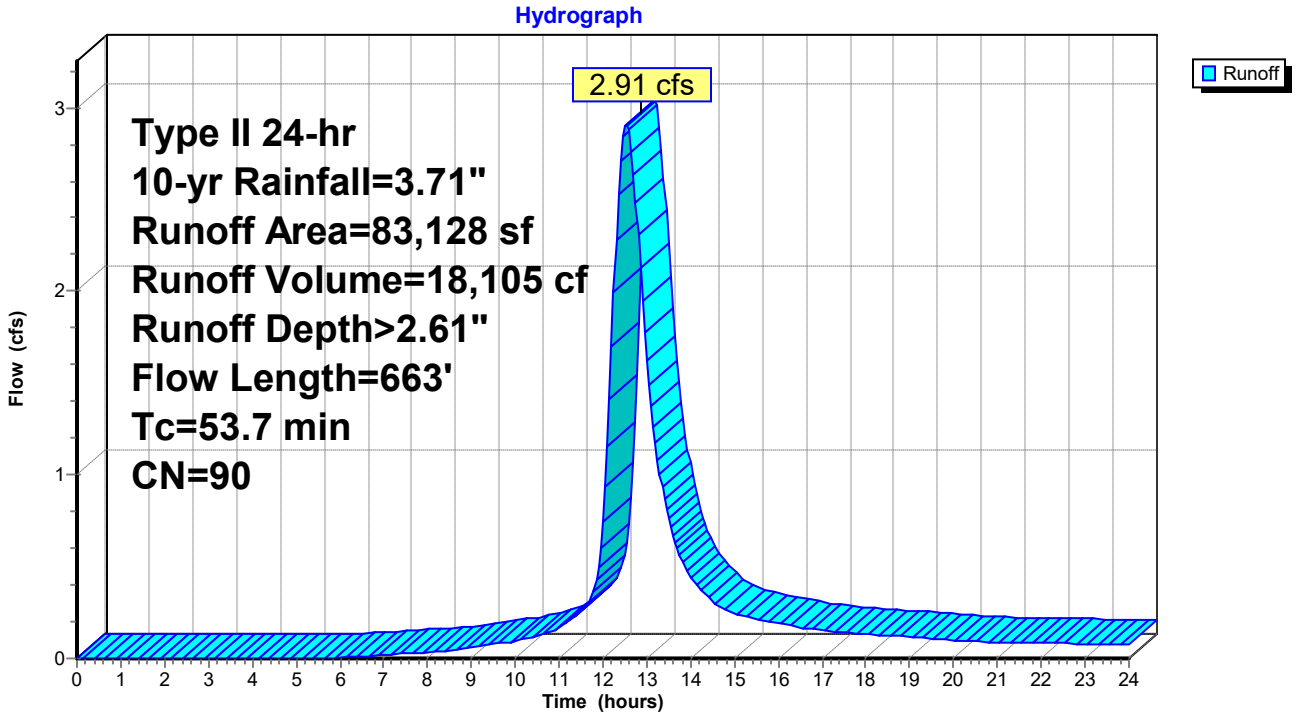
Runoff = 2.91 cfs @ 12.53 hrs, Volume= 18,105 cf, Depth> 2.61"
Routed to Pond 3P : Pond - Emergency Spillway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.71"

Area (sf)	CN	Description
47,377	98	Paved parking, HSG D
35,751	80	>75% Grass cover, Good, HSG D
83,128	90	Weighted Average
35,751		43.01% Pervious Area
47,377		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
2.6	133	0.0033	0.86		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.5	76	0.0150	2.49		**Shallow Concentrated Flow, Run #3** Paved Kv= 20.3 fps
0.2	42	0.0105	4.65	3.65	**Pipe Channel, Run #4** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.8	189	0.0075	3.93	3.09	**Pipe Channel, Run #5** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	123	0.0050	3.21	2.52	**Pipe Channel, Run #6** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
53.7	663	Total			

Subcatchment 1S: Proposed Drainage Area



Summary for Subcatchment 6S: Proposed Off-Site Drainage Area

[49] Hint: Tc<2dt may require smaller dt

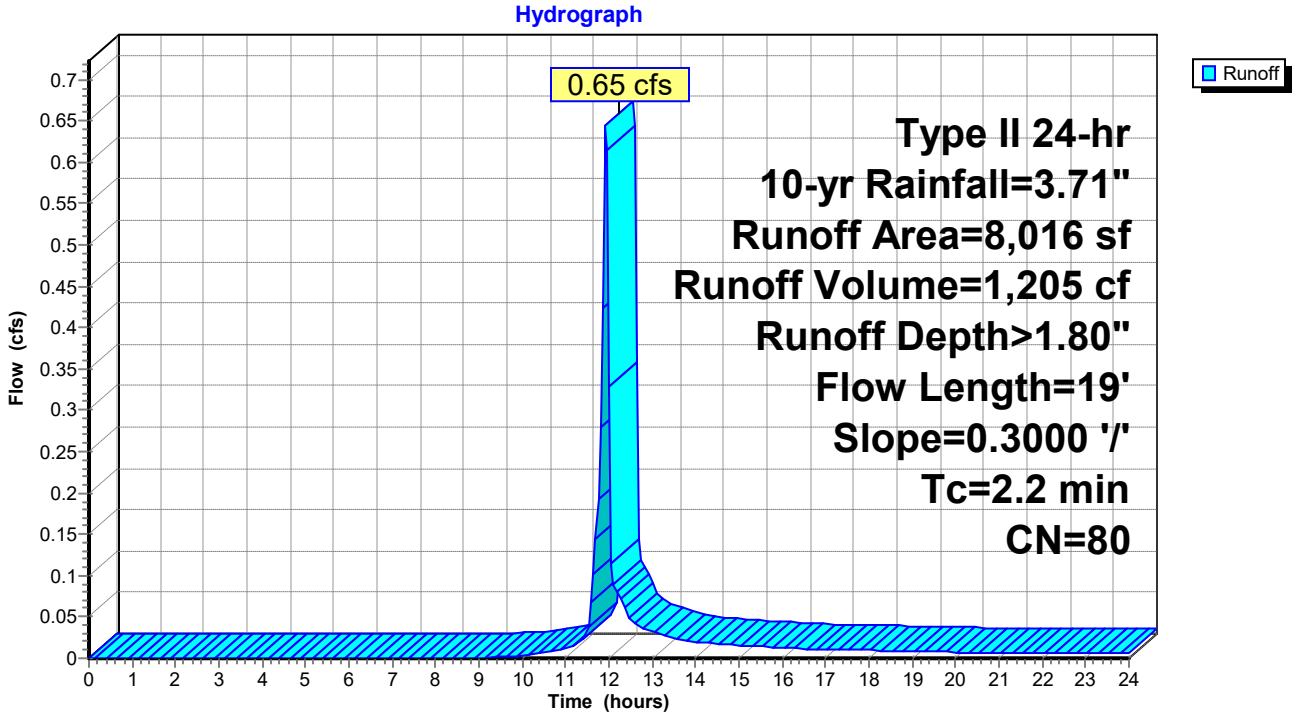
Runoff = 0.65 cfs @ 11.93 hrs, Volume= 1,205 cf, Depth> 1.80"
Routed to Pond 3P : Pond - Emergency Spillway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.71"

Area (sf)	CN	Description
8,016	80	>75% Grass cover, Good, HSG D
8,016		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	19	0.3000	0.15		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"

Subcatchment 6S: Proposed Off-Site Drainage Area



Summary for Pond 3P: Pond - Emergency Spillway

Inflow Area = 91,144 sf, 51.98% Impervious, Inflow Depth > 2.54" for 10-yr event
Inflow = 2.95 cfs @ 12.52 hrs, Volume= 19,310 cf
Outflow = 1.83 cfs @ 12.95 hrs, Volume= 10,797 cf, Atten= 38%, Lag= 25.7 min
Primary = 1.83 cfs @ 12.95 hrs, Volume= 10,797 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,079.02' @ 12.95 hrs Surf.Area= 4,608 sf Storage= 9,310 cf

Plug-Flow detention time= 207.4 min calculated for 10,797 cf (56% of inflow)
Center-of-Mass det. time= 100.7 min (935.1 - 834.4)

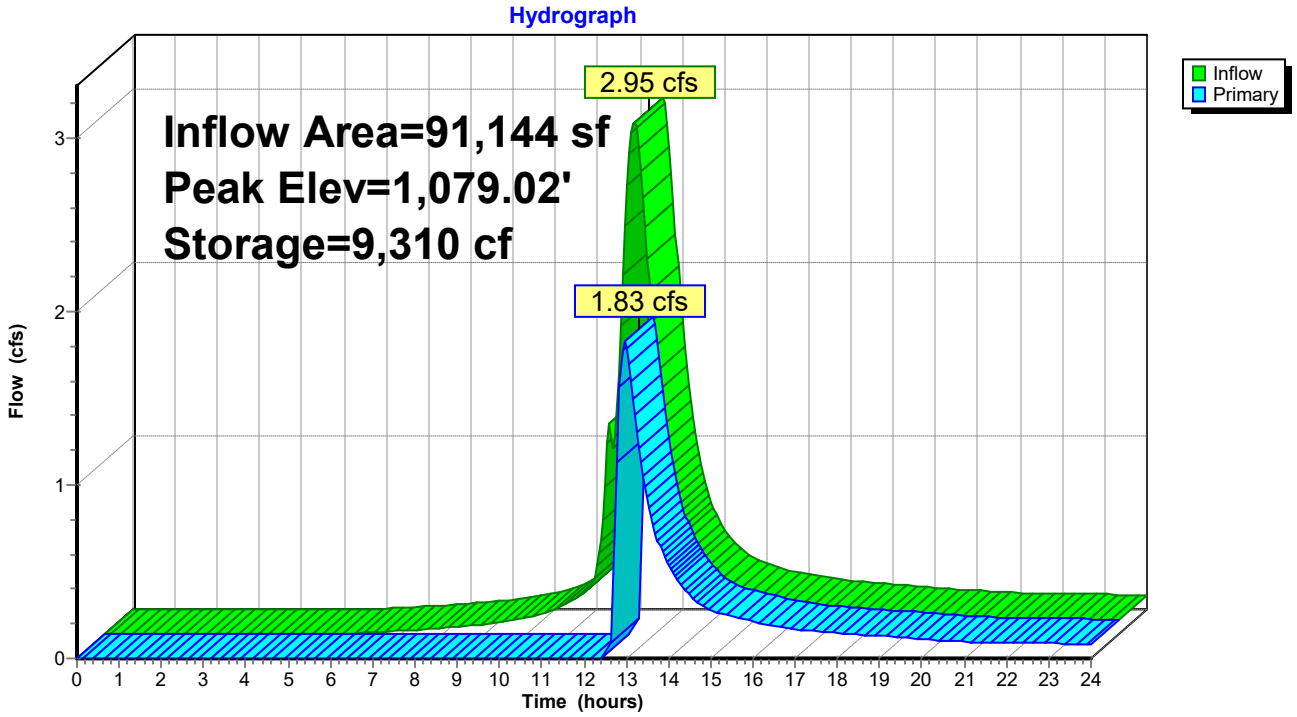
Volume	Invert	Avail.Storage	Storage Description
#1	1,075.80'	15,083 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,075.80	0	0	0
1,076.00	641	64	64
1,077.00	2,809	1,725	1,789
1,078.00	3,750	3,280	5,069
1,079.00	4,538	4,144	9,213
1,079.96	7,692	5,870	15,083

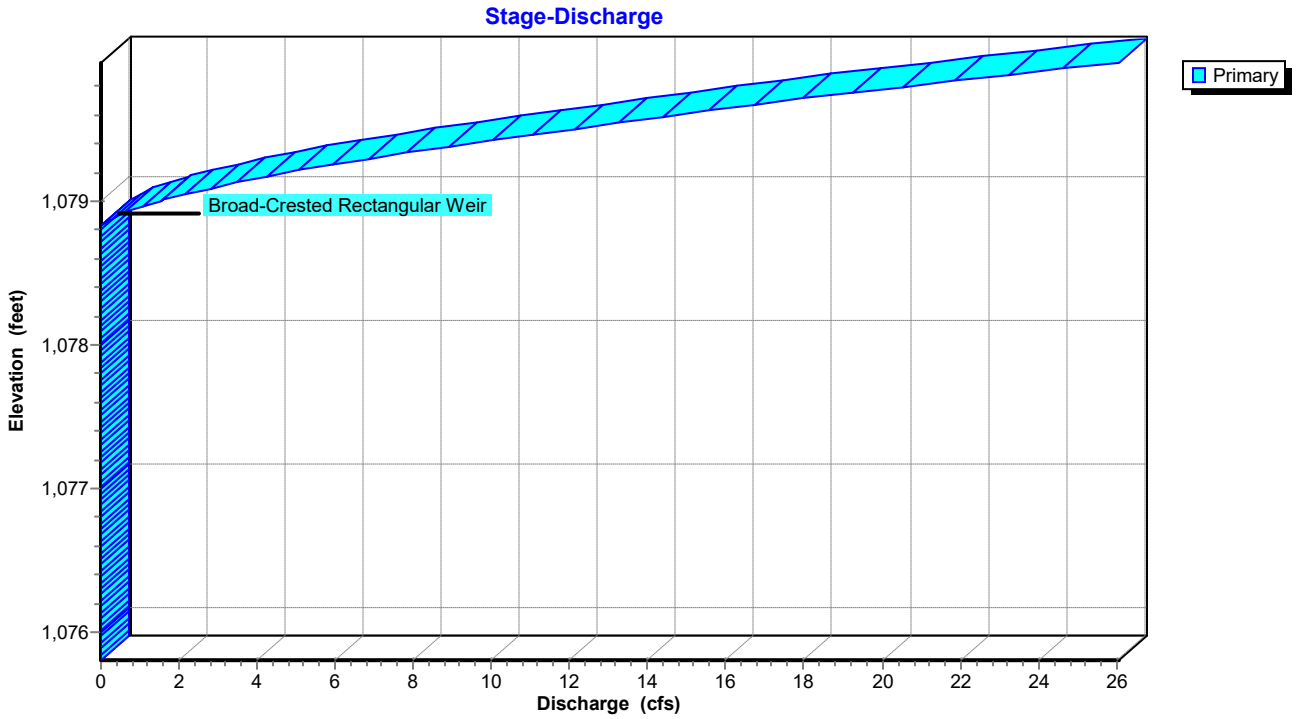
Device	Routing	Invert	Outlet Devices
#1	Primary	1,078.82'	**8.0' long x 10.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.52 2.58 2.70 2.68 2.67 2.68 2.67 2.64

Primary OutFlow Max=1.82 cfs @ 12.95 hrs HW=1,079.02' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.82 cfs @ 1.13 fps)

Pond 3P: Pond - Emergency Spillway



Pond 3P: Pond - Emergency Spillway



Summary for Subcatchment 1S: Proposed Drainage Area

[47] Hint: Peak is 116% of capacity of segment #5
[47] Hint: Peak is 142% of capacity of segment #6

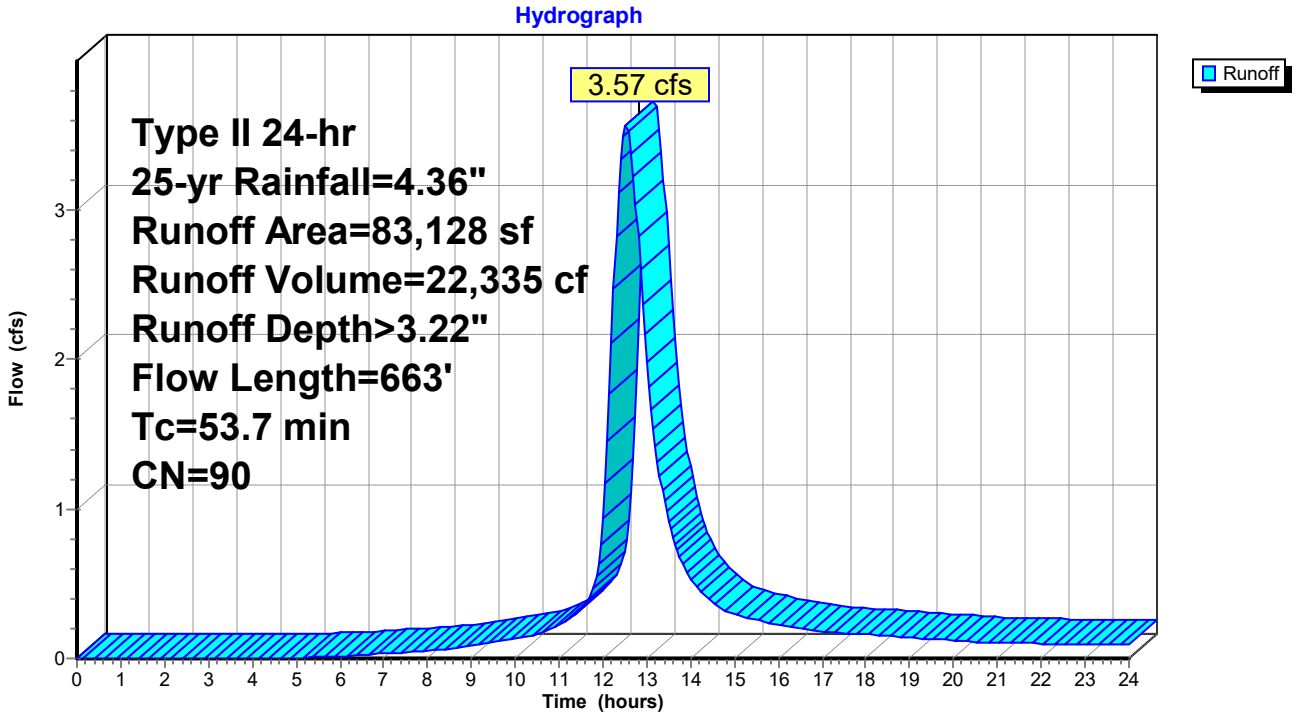
Runoff = 3.57 cfs @ 12.52 hrs, Volume= 22,335 cf, Depth> 3.22"
Routed to Pond 3P : Pond - Emergency Spillway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.36"

Area (sf)	CN	Description
47,377	98	Paved parking, HSG D
35,751	80	>75% Grass cover, Good, HSG D
83,128	90	Weighted Average
35,751		43.01% Pervious Area
47,377		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
2.6	133	0.0033	0.86		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.5	76	0.0150	2.49		**Shallow Concentrated Flow, Run #3** Paved Kv= 20.3 fps
0.2	42	0.0105	4.65	3.65	**Pipe Channel, Run #4** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.8	189	0.0075	3.93	3.09	**Pipe Channel, Run #5** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	123	0.0050	3.21	2.52	**Pipe Channel, Run #6** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
53.7	663	Total			

Subcatchment 1S: Proposed Drainage Area



Summary for Subcatchment 6S: Proposed Off-Site Drainage Area

[49] Hint: Tc<2dt may require smaller dt

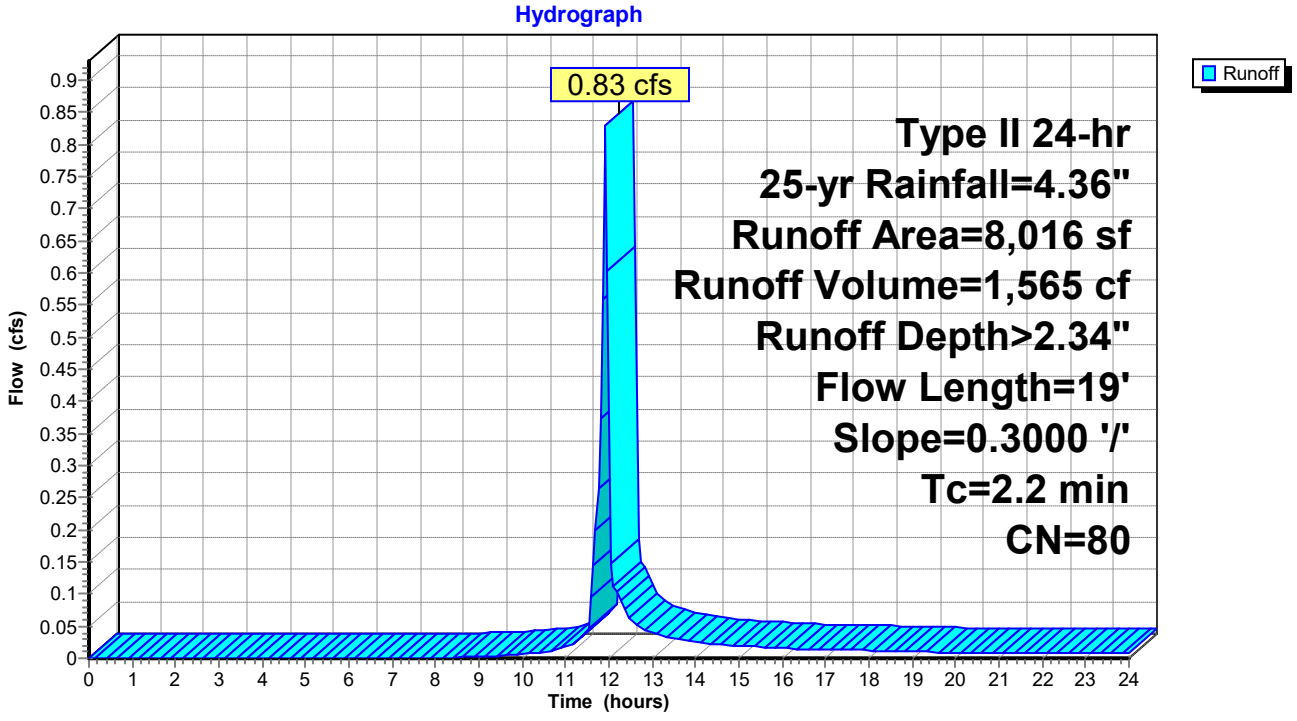
Runoff = 0.83 cfs @ 11.93 hrs, Volume= 1,565 cf, Depth> 2.34"
Routed to Pond 3P : Pond - Emergency Spillway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.36"

Area (sf)	CN	Description
8,016	80	>75% Grass cover, Good, HSG D
8,016		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	19	0.3000	0.15		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"

Subcatchment 6S: Proposed Off-Site Drainage Area



Summary for Pond 3P: Pond - Emergency Spillway

Inflow Area = 91,144 sf, 51.98% Impervious, Inflow Depth > 3.15" for 25-yr event
Inflow = 3.62 cfs @ 12.52 hrs, Volume= 23,900 cf
Outflow = 3.00 cfs @ 12.77 hrs, Volume= 15,374 cf, Atten= 17%, Lag= 15.2 min
Primary = 3.00 cfs @ 12.77 hrs, Volume= 15,374 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,079.10' @ 12.77 hrs Surf.Area= 4,863 sf Storage= 9,678 cf

Plug-Flow detention time= 177.0 min calculated for 15,374 cf (64% of inflow)
Center-of-Mass det. time= 79.2 min (907.8 - 828.6)

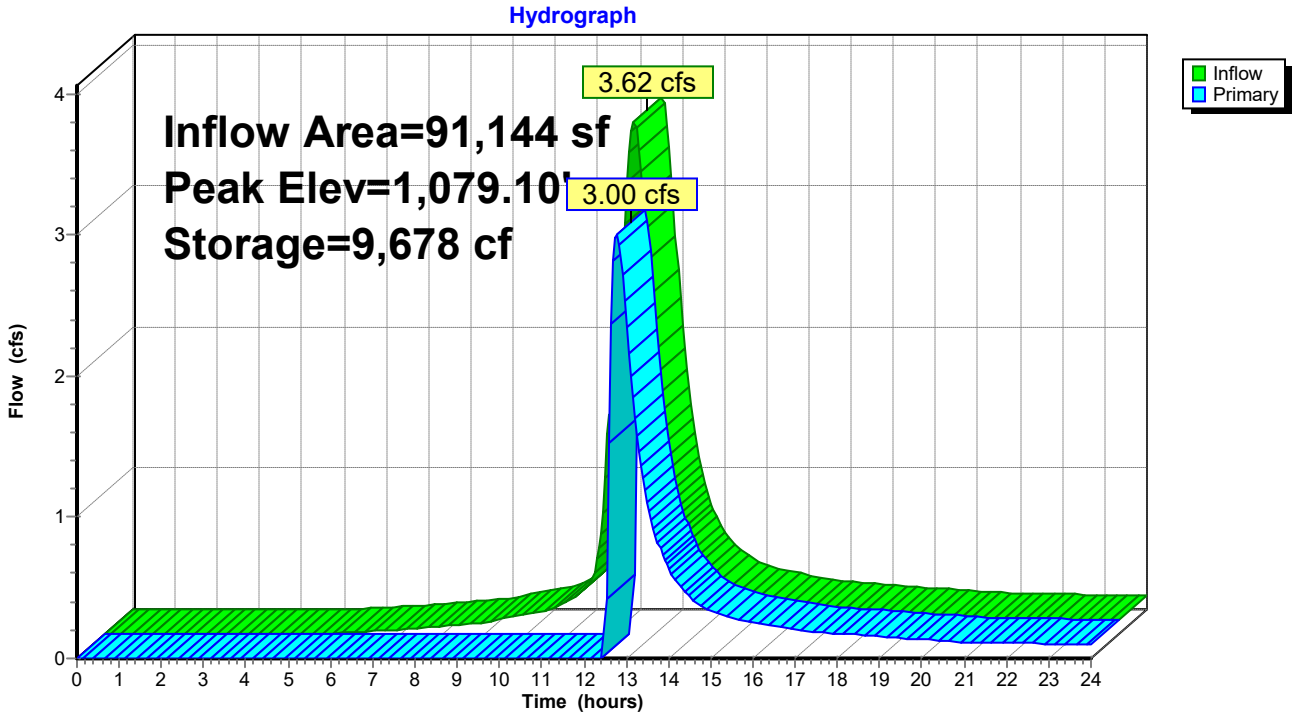
Volume	Invert	Avail.Storage	Storage Description
#1	1,075.80'	15,083 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,075.80	0	0	0
1,076.00	641	64	64
1,077.00	2,809	1,725	1,789
1,078.00	3,750	3,280	5,069
1,079.00	4,538	4,144	9,213
1,079.96	7,692	5,870	15,083

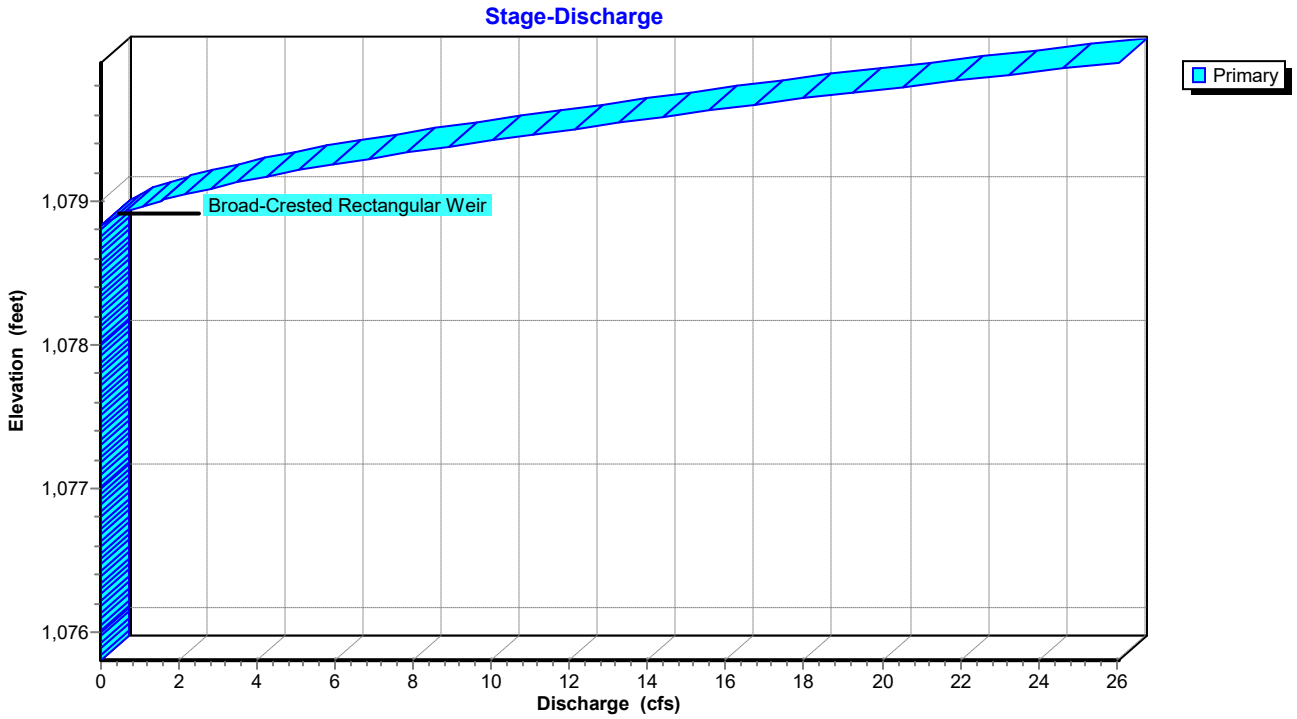
Device	Routing	Invert	Outlet Devices
#1	Primary	1,078.82'	**8.0' long x 10.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.52 2.58 2.70 2.68 2.67 2.68 2.67 2.64

Primary OutFlow Max=2.98 cfs @ 12.77 hrs HW=1,079.10' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 2.98 cfs @ 1.34 fps)

Pond 3P: Pond - Emergency Spillway



Pond 3P: Pond - Emergency Spillway



Summary for Subcatchment 1S: Proposed Drainage Area

[47] Hint: Peak is 112% of capacity of segment #4
[47] Hint: Peak is 133% of capacity of segment #5
[47] Hint: Peak is 163% of capacity of segment #6

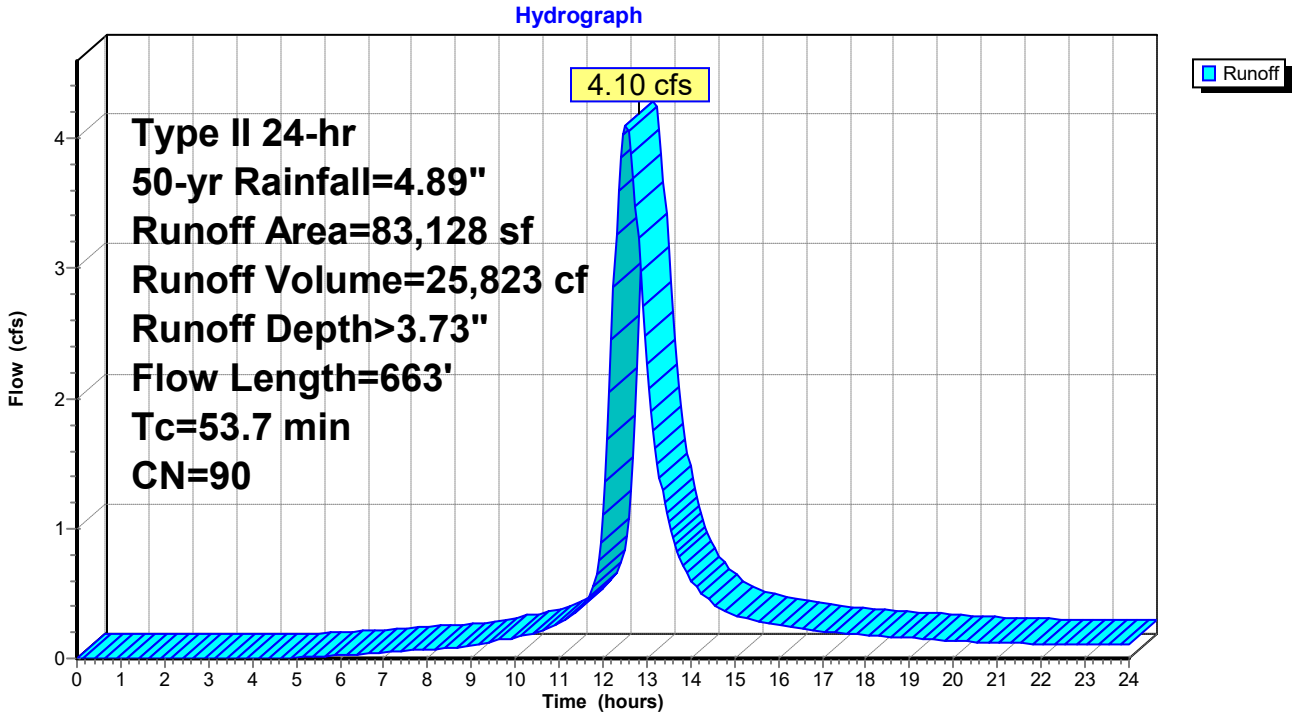
Runoff = 4.10 cfs @ 12.52 hrs, Volume= 25,823 cf, Depth> 3.73"
Routed to Pond 3P : Pond - Emergency Spillway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=4.89"

Area (sf)	CN	Description
47,377	98	Paved parking, HSG D
35,751	80	>75% Grass cover, Good, HSG D
83,128	90	Weighted Average
35,751		43.01% Pervious Area
47,377		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
2.6	133	0.0033	0.86		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.5	76	0.0150	2.49		**Shallow Concentrated Flow, Run #3** Paved Kv= 20.3 fps
0.2	42	0.0105	4.65	3.65	**Pipe Channel, Run #4** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.8	189	0.0075	3.93	3.09	**Pipe Channel, Run #5** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	123	0.0050	3.21	2.52	**Pipe Channel, Run #6** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
53.7	663	Total			

Subcatchment 1S: Proposed Drainage Area



Summary for Subcatchment 6S: Proposed Off-Site Drainage Area

[49] Hint: Tc<2dt may require smaller dt

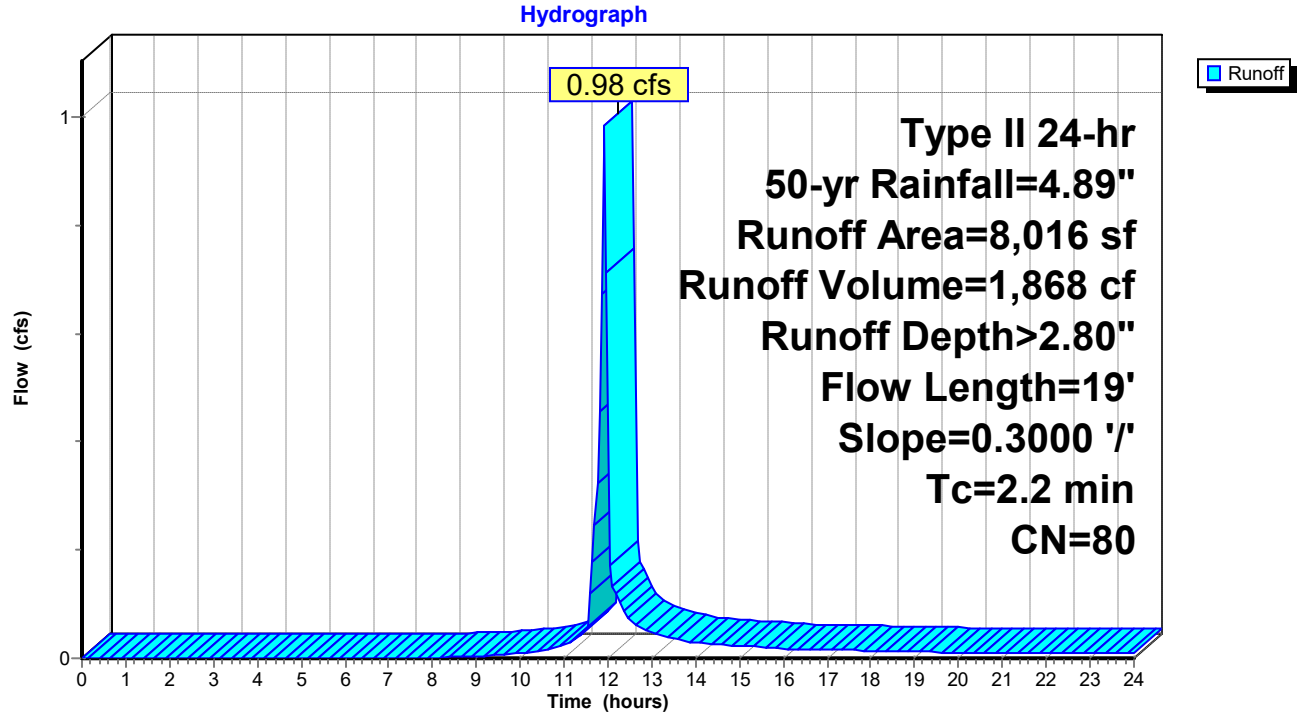
Runoff = 0.98 cfs @ 11.93 hrs, Volume= 1,868 cf, Depth> 2.80"
Routed to Pond 3P : Pond - Emergency Spillway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=4.89"

Area (sf)	CN	Description
8,016	80	>75% Grass cover, Good, HSG D
8,016		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	19	0.3000	0.15		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"

Subcatchment 6S: Proposed Off-Site Drainage Area



Summary for Pond 3P: Pond - Emergency Spillway

Inflow Area = 91,144 sf, 51.98% Impervious, Inflow Depth > 3.65" for 50-yr event
Inflow = 4.17 cfs @ 12.52 hrs, Volume= 27,691 cf
Outflow = 3.81 cfs @ 12.69 hrs, Volume= 19,156 cf, Atten= 9%, Lag= 10.4 min
Primary = 3.81 cfs @ 12.69 hrs, Volume= 19,156 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,079.15' @ 12.69 hrs Surf.Area= 5,016 sf Storage= 9,908 cf

Plug-Flow detention time= 161.3 min calculated for 19,156 cf (69% of inflow)
Center-of-Mass det. time= 69.4 min (893.9 - 824.6)

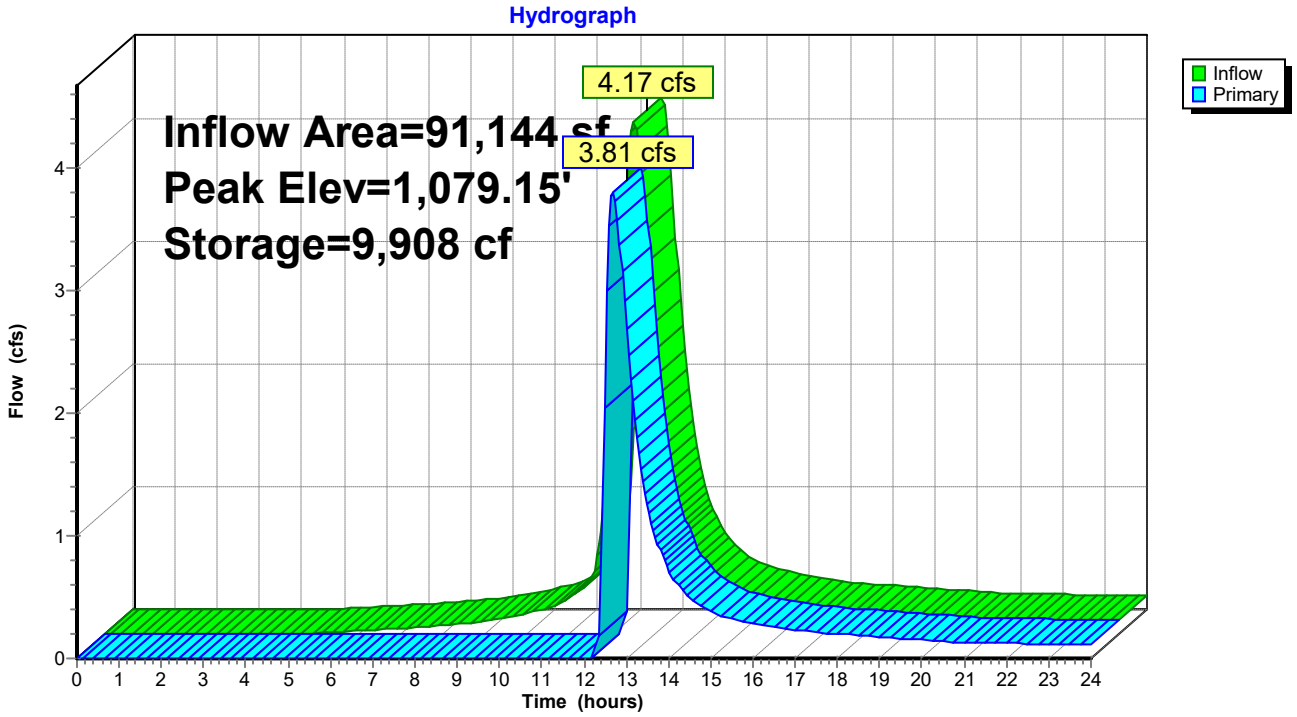
Volume	Invert	Avail.Storage	Storage Description
#1	1,075.80'	15,083 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,075.80	0	0	0
1,076.00	641	64	64
1,077.00	2,809	1,725	1,789
1,078.00	3,750	3,280	5,069
1,079.00	4,538	4,144	9,213
1,079.96	7,692	5,870	15,083

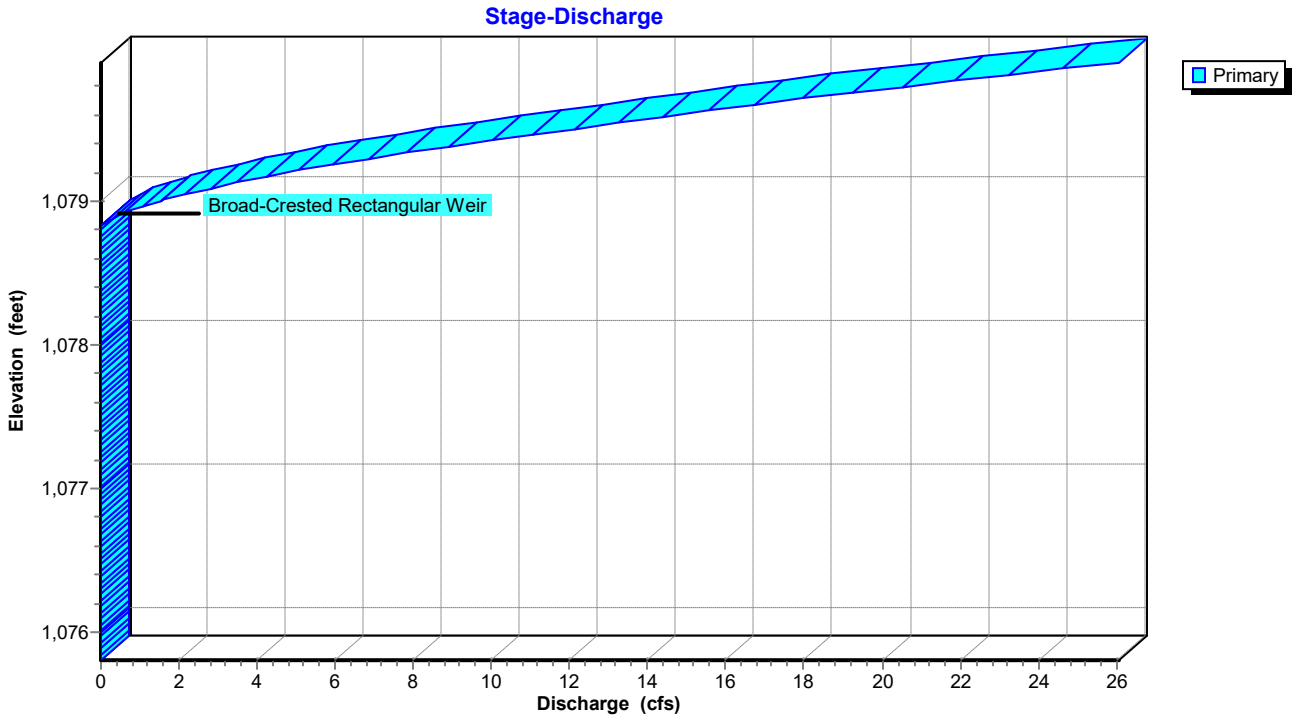
Device	Routing	Invert	Outlet Devices
#1	Primary	1,078.82'	**8.0' long x 10.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.52 2.58 2.70 2.68 2.67 2.68 2.67 2.64

Primary OutFlow Max=3.79 cfs @ 12.69 hrs HW=1,079.15' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 3.79 cfs @ 1.46 fps)

Pond 3P: Pond - Emergency Spillway



Pond 3P: Pond - Emergency Spillway



Summary for Subcatchment 1S: Proposed Drainage Area

[47] Hint: Peak is 127% of capacity of segment #4
[47] Hint: Peak is 151% of capacity of segment #5
[47] Hint: Peak is 185% of capacity of segment #6

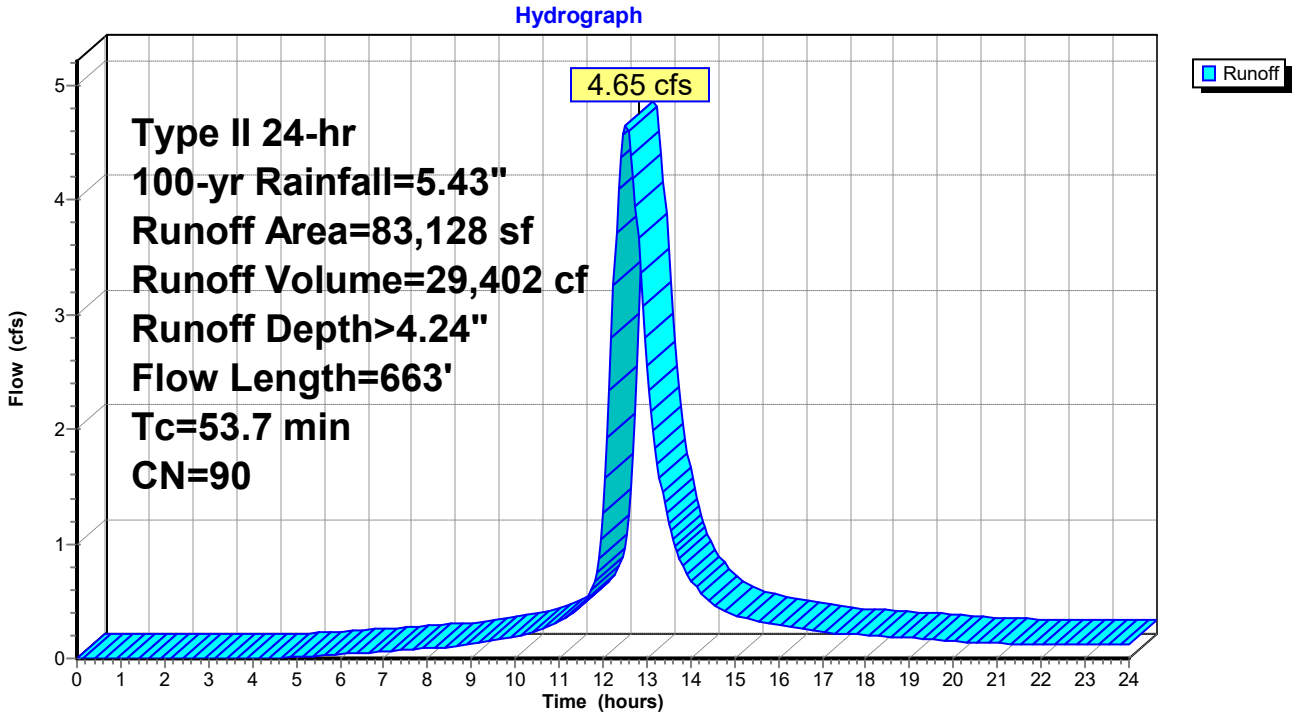
Runoff = 4.65 cfs @ 12.52 hrs, Volume= 29,402 cf, Depth> 4.24"
Routed to Pond 3P : Pond - Emergency Spillway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.43"

Area (sf)	CN	Description
47,377	98	Paved parking, HSG D
35,751	80	>75% Grass cover, Good, HSG D
83,128	90	Weighted Average
35,751		43.01% Pervious Area
47,377		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.0	100	0.0034	0.03		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"
2.6	133	0.0033	0.86		**Shallow Concentrated Flow, Run #2** Grassed Waterway Kv= 15.0 fps
0.5	76	0.0150	2.49		**Shallow Concentrated Flow, Run #3** Paved Kv= 20.3 fps
0.2	42	0.0105	4.65	3.65	**Pipe Channel, Run #4** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.8	189	0.0075	3.93	3.09	**Pipe Channel, Run #5** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	123	0.0050	3.21	2.52	**Pipe Channel, Run #6** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
53.7	663	Total			

Subcatchment 1S: Proposed Drainage Area



Summary for Subcatchment 6S: Proposed Off-Site Drainage Area

[49] Hint: Tc<2dt may require smaller dt

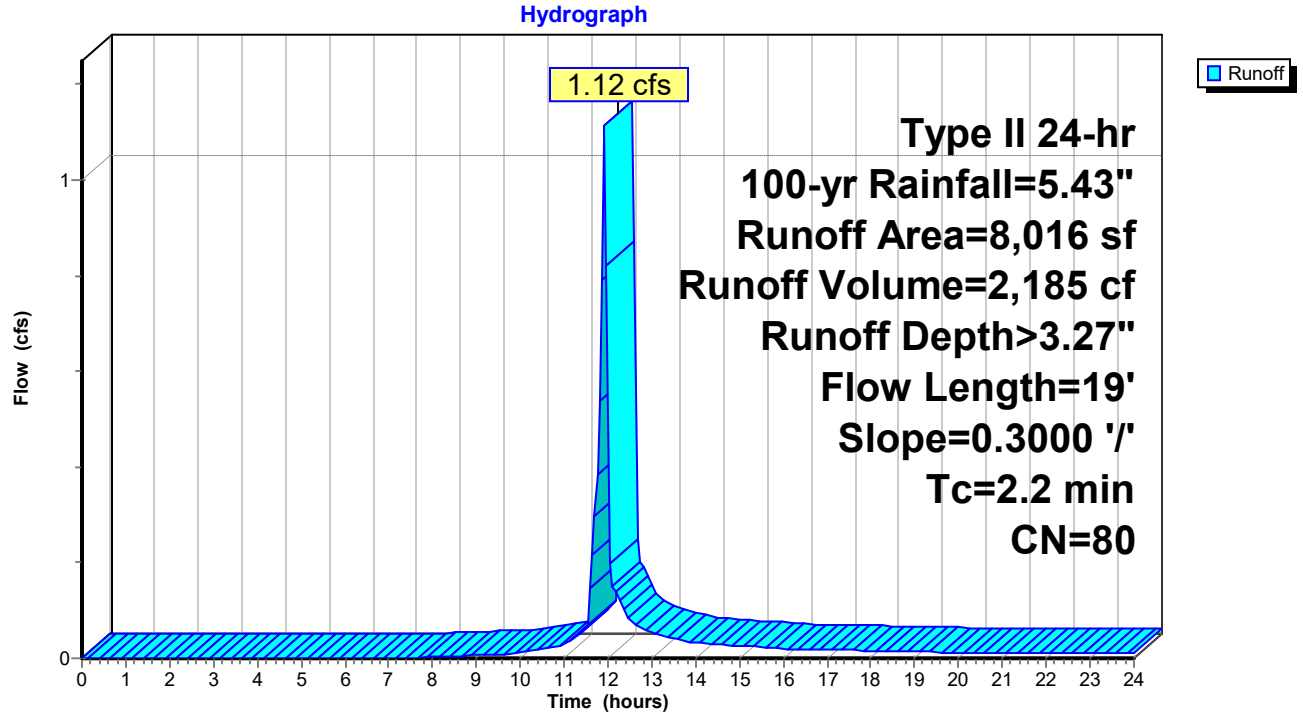
Runoff = 1.12 cfs @ 11.92 hrs, Volume= 2,185 cf, Depth> 3.27"
Routed to Pond 3P : Pond - Emergency Spillway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.43"

Area (sf)	CN	Description
8,016	80	>75% Grass cover, Good, HSG D
8,016		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	19	0.3000	0.15		**Sheet Flow, Run #1** Grass: Bermuda n= 0.410 P2= 2.64"

Subcatchment 6S: Proposed Off-Site Drainage Area



Summary for Pond 3P: Pond - Emergency Spillway

Inflow Area = 91,144 sf, 51.98% Impervious, Inflow Depth > 4.16" for 100-yr event
Inflow = 4.73 cfs @ 12.52 hrs, Volume= 31,587 cf
Outflow = 4.52 cfs @ 12.64 hrs, Volume= 23,042 cf, Atten= 4%, Lag= 7.3 min
Primary = 4.52 cfs @ 12.64 hrs, Volume= 23,042 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,079.18' @ 12.64 hrs Surf.Area= 5,142 sf Storage= 10,103 cf

Plug-Flow detention time= 148.7 min calculated for 22,994 cf (73% of inflow)
Center-of-Mass det. time= 62.8 min (883.8 - 821.0)

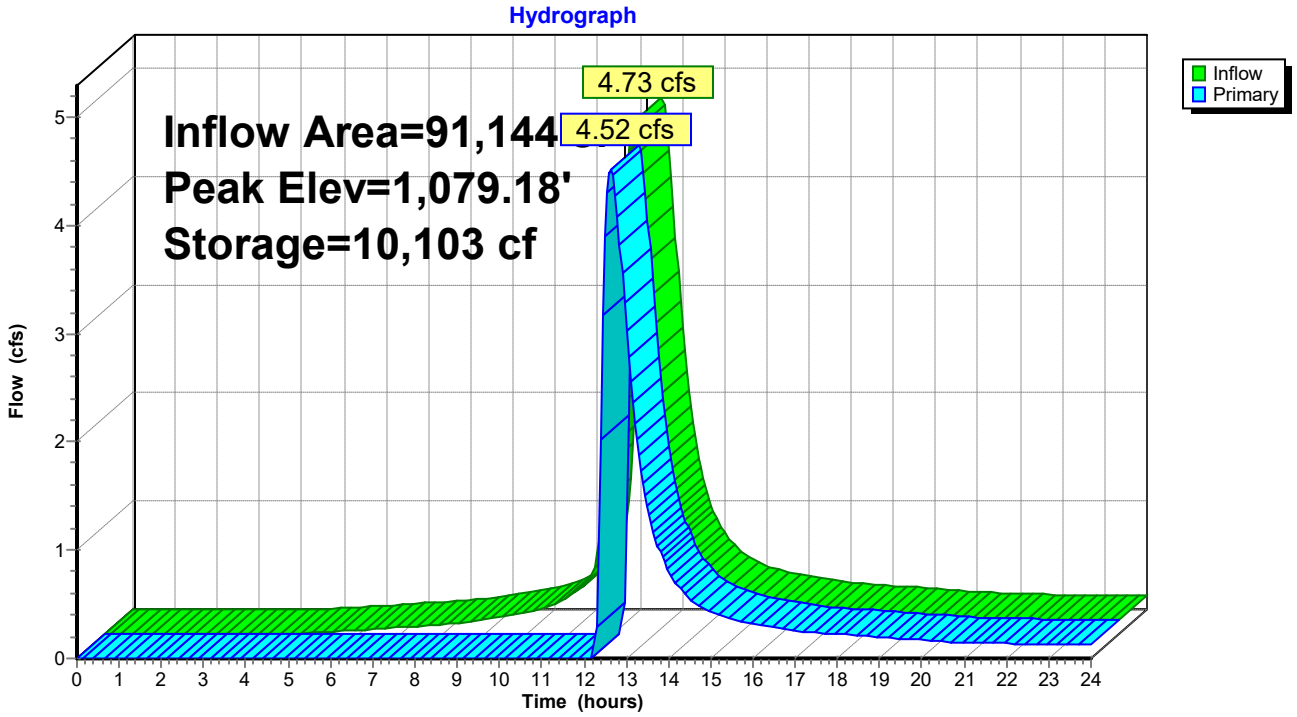
Volume	Invert	Avail.Storage	Storage Description
#1	1,075.80'	15,083 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,075.80	0	0	0
1,076.00	641	64	64
1,077.00	2,809	1,725	1,789
1,078.00	3,750	3,280	5,069
1,079.00	4,538	4,144	9,213
1,079.96	7,692	5,870	15,083

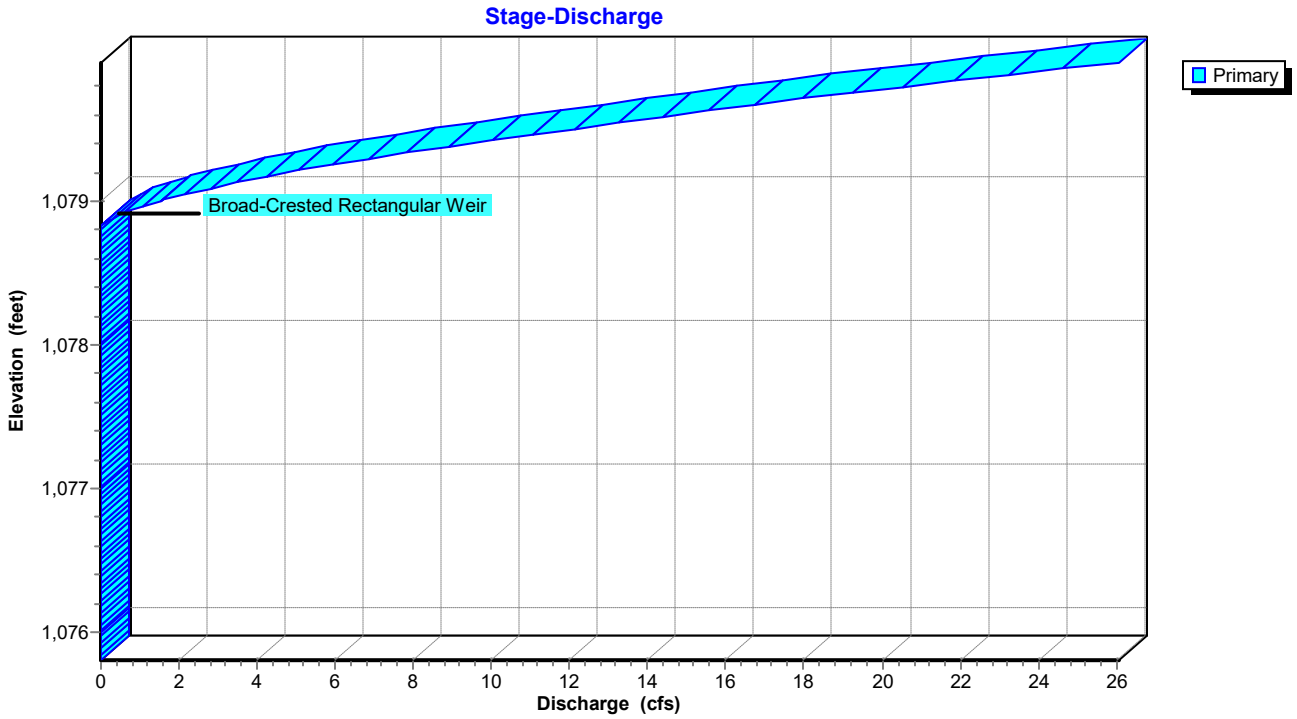
Device	Routing	Invert	Outlet Devices
#1	Primary	1,078.82'	**8.0' long x 10.7' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.52 2.58 2.70 2.68 2.67 2.68 2.67 2.64

Primary OutFlow Max=4.50 cfs @ 12.64 hrs HW=1,079.18' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 4.50 cfs @ 1.55 fps)

Pond 3P: Pond - Emergency Spillway

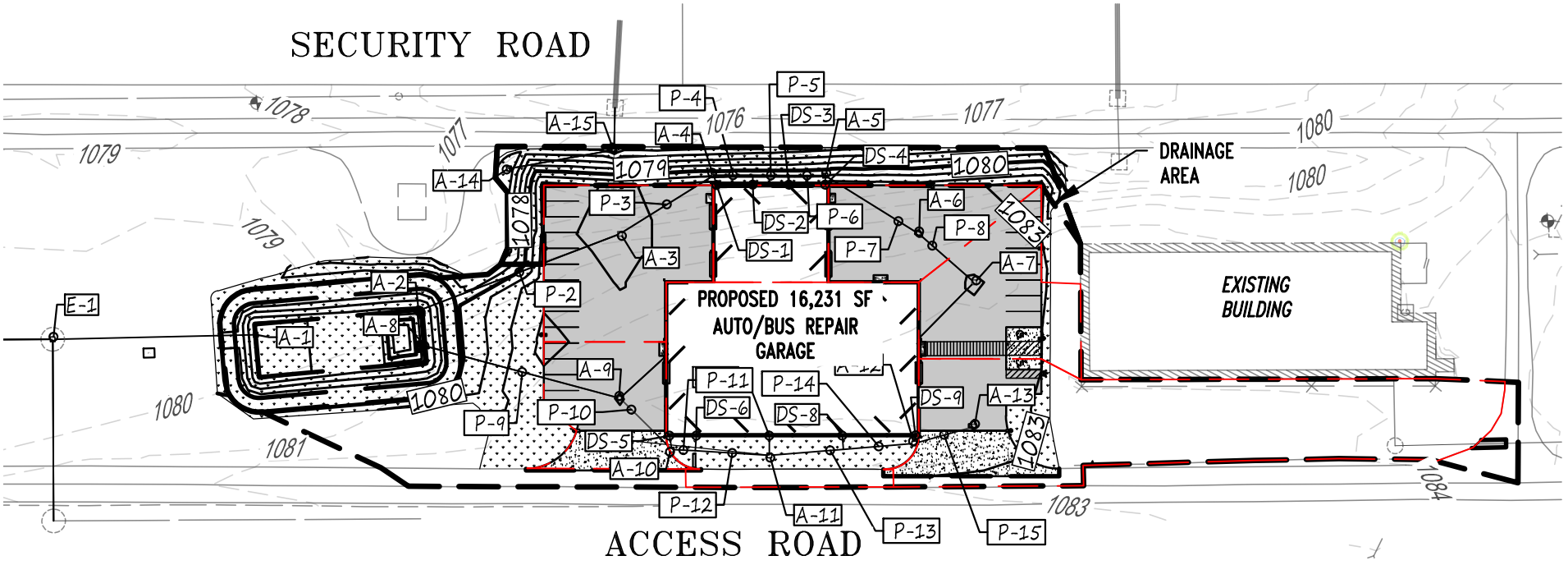


Pond 3P: Pond - Emergency Spillway



SECTION 10

CDSS PIPE SIZING EXHIBIT & CALCULATIONS



SUBCATCHMENT AREAS

SUBCATCHMENT	PIPE	CDSS FROM JUNCTION	CDSS TO JUNCTION	PERVIOUS (AC)	IMPERVIOUS (AC)	TOTAL (AC)
A-3	P-2	A-3	A-2	-	0.1780	0.18
A-4	P-3	A-4	A-3	-	0.0209	0.02
DS-2	P-4	DS-2	A-4	-	0.0209	0.02
DS-3	P-5	DS-3	DS-2	-	0.0209	0.02
A-5	P-6	A-5	DS-3	-	0.0209	0.02
A-6	P-7	A-6	A-5	-	0.1101	0.11
A-7	P-8	A-7	A-6	0.0255	0.1150	0.14
A-9	P-9	A-9	A-8	0.0721	0.1060	0.18
A-10	P-10	A-10	A-9	-	0.0684	0.07
DS-6	P-11	DS-6	A-10	-	0.0684	0.07
A-11	P-12	A-11	DS-6	0.0604	0.0984	0.16
DS-8	P-13	DS-8	A-11	-	0.0684	0.07
A-12	P-14	A-12	DS-8	-	0.0684	0.07
A-13	P-15	A-13	A-12	0.2926	0.1093	0.40

SCALE: 1:90

CDSS Exhibit

LoCI Auto Repair Garage

1580 OH-56
London, OH 43140

COUNTY OF
Madison

SCALE: AS NOTED

DATE: ---

PROJECT NO.: N24019

DRAWN BY: ---

CHECKED BY: ---

JMW SITE DESIGN
P.O. Box 74
Canfield, OH 44406
330-422-8603
jmwsitedesign.com

CURRENT REV: ---

SHEET NO.: ST-3

E:\GPD GROUP\2024\N24019 - LOCI - LONDON, OH\DRAWINGS\ST-3 CDSS EXHIBIT.DWG
7/31/2025

STORM SEWER SYSTEM

PID : N24019 **Date :** 02/13/2025 **Project :** LOCI **Location :** London, OH

Description : Auto/Bus Repair Garage **Designer :** CB

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 0.00 **Tailwater Elevation (ft.):** 1078.23

JUNCTION From	To	STATION From To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
A3	A2	2	0.18 0.18	0.16 0.16	12.17	4.88	5.78	2.2	2.5	12	123.1	0.0050	1077.23 1076.62	3.16	2.34	0.0068	1079.07 1078.23	1082.02 1082.02	2.95	3.79	CB 0.015
A4	A3	3	0.02 0.20	0.02 0.18	11.87	4.93	5.78	1.4	1.6	12	63.1	0.0075	1077.77 1077.30	3.43	2.87	0.0028	1079.24 1079.07	1081.01 1082.02	1.77	2.24	MH 0.015
DS2	A4	4	0.02 0.22	0.02 0.20	11.76	4.95	5.78	1.3	1.5	12	22.0	0.0077	1078.04 1077.87	3.41	2.92	0.0024	1079.29 1079.24	1080.79 1080.77	1.50	1.75	MH 0.015
DS3	DS2	5	0.02 0.24	0.02 0.22	11.65	4.97	5.78	1.2	1.4	12	21.0	0.0073	1078.19 1078.04	3.30	2.84	0.0021	1079.34 1079.29	1082.79 1081.00	3.45	3.60	CB 0.015
A6	A5	7	0.11 0.35	0.10 0.32	11.22	5.05	5.78	1.0	1.2	12	62.8	0.0075	1078.82 1078.35	3.19	2.87	0.0015	1079.47 1079.37	1081.00 1081.97	1.53	1.18	CB 0.015
A7	A6	8	0.14 0.49	0.11 0.42	11.00	5.10	6.16	0.5	0.7	12	42.0	0.0124	1079.34 1078.82	3.18	3.70	0.0004	1079.64 1079.49	1081.91 1081.97	2.27	1.57	CB 0.015
A5	DS3	6	0.02 0.51	0.02 0.44	11.55	4.99	5.78	1.1	1.3	12	20.8	0.0077	1078.35 1078.19	3.28	2.91	0.0018	1079.37 1079.34	1081.00 1080.80	1.63	1.65	0.015

STORM SEWER SYSTEM

PID : N24019 **Date :** 02/13/2025 **Project :** LOCI **Location :** London, OH

Description : Auto/Bus Repair Garage - A8 **Designer :** CB

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 12.00 **Tailwater Elevation (ft.):** 1078.23

JUNCTION From	To	STATION From To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
A9	A8	9	0.18 0.18	0.10 0.10	15.96	4.30	5.08	2.6	3.1	15	115.0	0.0050	1077.15 1076.57	3.46	4.28	0.0030	1078.58 1078.23	1081.96 1078.17	3.38	3.56	CB 0.015
A10	A9	10	0.07 0.25	0.06 0.16	15.80	4.32	5.08	2.2	2.6	12	41.7	0.0098	1077.66 1077.25	4.22	3.29	0.0069	1078.86 1078.58	1082.64 1081.96	3.78	3.98	MH 0.015
DS6	A10	11	0.07 0.31	0.06 0.23	15.74	4.33	5.08	1.9	2.2	12	13.4	0.0104	1077.90 1077.76	4.22	3.40	0.0053	1078.93 1078.86	1082.18 1082.64	3.25	3.28	CB 0.015
DS8	A11	13	0.07 0.38	0.06 0.29	15.38	4.38	5.24	1.2	1.5	12	42.0	0.0102	1078.86 1078.43	3.74	3.36	0.0023	1079.34 1079.19	1082.57 1081.16	3.23	2.71	MH 0.015
A11	DS6	12	0.16 0.54	0.10 0.39	15.57	4.35	5.08	1.7	1.9	12	42.4	0.0101	1078.33 1077.90	4.03	3.34	0.0039	1079.10 1078.93	1082.16 1082.65	3.06	2.83	CB 0.015
A12	DS8	14	0.07 0.61	0.06 0.45	15.19	4.41	5.27	1.0	1.2	12	40.6	0.0101	1079.27 1078.86	3.49	3.34	0.0014	1079.69 1079.59	1082.58 1082.57	2.89	2.31	0.015
A13	A12	15	0.40 1.01	0.16 0.61	15.00	4.43	5.31	0.7	0.8	12	35.5	0.0099	1079.72 1079.37	3.17	3.30	0.0007	1080.09 1080.06	1081.95 1082.52	1.86	1.23	0.015

SECTION 11

EMAIL FROM MADISON COUNTY DEPUTY ENGINEER

From: Ken Koppes
To: Julio Williams
Subject: RE: LoCI Facility
Date: Wednesday, December 11, 2024 11:03:43 AM
Attachments: image004.jpg
image001.jpg
image002.jpg

Julio,

I apologize for not getting back sooner.

The Engineer's Office will not need to review your plans for the auto and bus repair garage at LoCI.

We will also not require storm water calculations for peak flow or detention.

State agencies are exempt from these requirements.

If you have any other questions, let me know.

Thank you.

Kenneth L. Koppes, PE
Madison County Deputy Engineer / Ditch Maintenance Program Manager
825 US 42 NE
London, OH 43140
(740) 852-9404
fax: (740) 852-9530
cell: (614) 623-6548
Email: ken.koppes@madison.oh.gov
www.co.madison.oh.us

Office Hours April – Oct (summer hours)
Mon-Thurs 7AM-5PM
Closed Friday

Nov – Mar (winter hours)
Mon-Fri 7:30AM – 3:30PM

From: Julio Williams [mailto:jwilliams@jmwsitedesign.com]
Sent: Wednesday, December 11, 2024 10:46 AM
To: Ken Koppes <Ken.Koppes@madison.oh.gov>
Subject: RE: LoCI Facility

Hi Ken – Have you had a chance to consider the email below?

Thanks,

Julio A. Williams, P.E., CPESC
Operations Manager

From: Julio Williams
Sent: Tuesday, December 3, 2024 7:57 AM
To: Ken Koppes <Ken.Koppes@madison.oh.gov>
Subject: RE: LoCI Facility

Hi Ken,

As a follow up to our conversation last week, please find a preliminary version of the site plan we discussed. LoCI plans to build an auto and bus repair garage on about 1-acre of their property. I'd like to confirm the following:

1. Will The county engineer's office will need to review the plans for compliance with land development requirements as the applicant applies for permits?
2. Will the county engineer require that this development complies with the county's stormwater peak flow requirements? This will require that some form of peak flow detention be part of the land development design.
3. Can you confirm your role / position with the county engineer's office?

Regardless of your response, we intend to comply with the State's NPDES General stormwater permit and any requirements of the soil & water district for erosion and sediment control.

Thanks again for your consideration,

Julio A. Williams, P.E., CPESC
Operations Manager

From: Ken Koppes <Ken.Koppes@madison.oh.gov>
Sent: Wednesday, November 27, 2024 11:36 AM
To: Julio Williams <jwilliams@jmwsitedesign.com>
Subject: RE: LoCI Facility

Julia Cumming
Program Administrator

Madison Soil and Water Conservation District
831 US HWY 42 NE
London, OH 43140
Office: 740-852-4003 (Option 3)
Mobile: 614-307-4178
Website: madisonsoilandwater.com

From: Julio Williams [mailto:jwilliams@jmwsitedesign.com]
Sent: Wednesday, November 27, 2024 11:15 AM
To: Ken Koppes <ken.koppes@madison.oh.gov>
Subject: LoCI Facility

https://teams.microsoft.com/l/meetup-join/19:meeting_MjVmYTVhYmYtMGI0NC00N2Y3LTk4MmYtZmVjM2FmYTczZTNl@thread.v2/0?context=%7B%22Tid%22:%22c65e1f54-40eb-49d8-be1d-656134250393%22,%22Oid%22:%224e5fbbf3-0ab3-41b2-be10-969a1cda5b5b%22%7D

Julio A. Williams, P.E., CPESC
Operations Manager

T: 330-422-8603
F: 419-314-6374
jwilliams@jmwsitedesign.com
www.jmwsitedesign.com



P.O. Box 74 | Canfield, OH 44406

The content of this email is confidential and intended for the recipient specified in message only. It is strictly forbidden to share any part of this message with any third party, without a written consent of the sender. If you received this message by mistake, please reply to this message and follow with its deletion, so that we can ensure such a mistake does not occur in the future.

Document 00 41 13 - Bid Form (General Contract / Electronic Bid)
State of Ohio Standard Requirements for Public Facility Construction

THIS SAMPLE BID FORM IS PROVIDED WITH THE PROJECT MANUAL AS A PLACEHOLDER ONLY – SUBMIT YOUR BID USING THE ELECTRONIC BID FORM ON HTTPS://BIDEXPRESS.COM

General Info

Alt Total: Bid Total:

Deadline
October 20, 2025, 1 PM EST

Advertised
September 22, September 29, and October 06, 2025

Number
DRC-23L009

Business Name
Ohio Department of Rehabilitation & Correction
PO Box 430 Columbus
Ohio 43216

Description
LoCI Auto School Building
New PEMB building with (2) garages spaces and supporting general building and administrative spaces.

Procurement Documents

00 11 13	Advertisement for Bids
00 21 13	Instructions to Bidders
00 22 00	Supplementary Instructions
00 41 13	Bid Form
00 43 13	Bid Security Form
00 45 13	Bidder's Qualifications
00 45 39	EDGE Affidavit
00 52 00	Agreement Form
00 52 14	Subcontract Form (OAC 153:1-03-02)
00 61 13	Performance and Payment Bond Form
00 71 00	Contracting Definitions
00 72 13	General Conditions
00 73 00	Supplementary Conditions
00 73 43	Wage Rate Requirements

«4» Attachments

Contract Times and Addenda

Contract Times

The time for Substantial Completion of all Work is 364 consecutive days from the Notice to Proceed.

Acknowledgement of receipt of Addenda

Date Addendum #1 Received	Date Addendum #2 Received	Date Addendum #3 Received	Date Addendum #4 Received

Allowance Instructions

Allowance amounts are fixed and no entry of data is required by the Bidder. Include each and every Allowance amount in the Base Bid. The Bidder's Fee (overhead and profit) and costs for unloading and handling on the Site, labor, installation costs, and other expenses contemplated for the Allowance must be included in the Base Bid and NOT in the Allowance amount.

Allowances (General Contract)

Item	Description	Allowance Amount*	Extension
Allowance 1	Undercutting & Removing unsuitable soils and replacing	$170,000	-

Unit Price Instructions

Enter the price per unit of measure in the Bid Form and the extension will be automatically calculate. Include the Extension for each and every Unit Price in the Base Bid. Unit prices will be used solely for the purpose of determining the adjustment to the Contract Sum for differences between the estimated quantities on the electronic Bid Form and the actual quantities provided.

Unit Prices (General Contract)

Item	Description	Quantity	Unit Price*	Unit of Measure	Extension
Unit Price A	Cost of undercutting and removing unsuitable subgrade soils and replacing with TX 160 Geogrid and ODOT 304 aggregate base material, as directed by the engineer.	-	_____	Square Yards/24" Deep	
«5» Items				**Total:**	

Base Bid Instructions

Enter the amount of the Base Bid for ALL LABOR AND MATERIALS to complete the scope of Work. Include the amount of each Allowance (if applicable) and the subtotal of each Unit Price Extension (if applicable) in the Base Bid amount. Failure to include Allowance or Unit Price Extensions in the Base Bid is the responsibility of the Bidder and will not be sufficient reason for adjustment of the Bid amount after the Bid deadline. Do not include Alternates (if applicable) in the Base Bid amount.

Base Bid (General Contract)

Item	Description	Base Bid Amount*	Extension
Base Bid	All Labor and Materials (include Allowances and Unit Price Extensions above)	_____	
1 Item		**Total:**	

Alternate Instructions

Enter the amount of each and every Alternate to ADD TO or DEDUCT FROM the Base Bid. Indicate amounts to DEDUCT FROM the Base Bid by entering a minus sign (-) before the amount entered. Do not include Alternate amounts in the Base Bid.

Alternates (General Contract)

Item	Description	Alternate Amount*	Extension
! Alternate: Owner-agency may award independently from entire bid.			
! Alternates are not included in bid total.			
Alternate 1	Canopy	_____	
Alternate 2	Masonry Wainscot	_____	
Alternate 3	Building Color	_____	
Alternate 4	Clerestory Windows	_____	
Alternate 5	Office Casework & Plumbing	_____	
«5» Items		**Alternate Total:**	**Total:**

Bidder Affirmation and Disclosure

The Bidder acknowledges that by submitting its Bid, the Bidder has read and understands the applicable Executive Orders regarding the prohibitions of performance of offshore services, locating State data offshore in any way, or purchasing from Russian institutions or companies. If awarded a Contract, the Bidder will become the Contractor and affirms that both the Contractor and its Subcontractors shall perform no services requested under this Contract outside of the United States.

The Bidder shall provide the locations where services under this Contract will be performed in the spaces provided below or by attachment. Failure to provide this information as part of its Bid may cause the Bidder to be deemed non-responsive and no further consideration will be given to its Bid. If the Bidder will not be using Subcontractors, indicate "Not Applicable" in the appropriate spaces.

1. Principal business location of Contractor:

Contractor Address*

City, State, and Zip*

Name / Principal business location of Subcontractor(s), if known at time of Bid deadline:

Subcontractor Name*

Address, City, State, and Zip*

2. Location(s) where services will be performed by Contractor (Project Sites):

Name*

Address, City, State, and Zip*

Name(s) / Location(s) where services will be performed by Subcontractors (Project Sites):

Subcontractor Name

Address, City, State, and Zip

3. Location(s) where State data will be located by Contractor:

Address*

City, State, and Zip*

Location(s) where State data will be located by Subcontractor(s), if known at time of Bid deadline:

Subcontractor Name

Address, City, State, and Zip

Bidder also affirms, understands and agrees that the Contractor and its Subcontractors are under a duty to disclose to the State any change or shift in location of services performed by the Contractor or its Subcontractors before, during and after execution of any Contract with the State. Bidder agrees it shall so notify the State immediately of any such change or shift in location of its services. The State has the right to immediately terminate the contract, unless a duly signed waiver from the State has been attained by the Contractor to perform the services outside the United States.

On behalf of the Bidder, I acknowledge that I am duly authorized to execute this electronic Bid Form including this Bidder Affirmation and Disclosure form and have read and understand that this form is a part of any Contract that Bidder may enter into with the State and is incorporated therein.

EDGE Program Commitment to Participate

Option A

The Bidder commits to meet or exceed the advertised EDGE Participation Goal of the Contract award amount, calculated as a portion of the Base Bid plus all accepted Alternates, by using EDGE-certified Business(es).

The Bidder agrees that if selected for consideration of the Contract, it shall provide (if not provided with the Bidder's Bid) to the Contracting Authority, at the location required and within 3 business days after receiving notice from the Contracting Authority, its fully completed Bidder's Qualification Form, including an EDGE Affidavit form for each EDGE-certified Business proposed for use by the Bidder if awarded the Contract for this Project.

Option B (indicate percentage of participation below)

The Bidder declares that it does not meet the advertised EDGE Participation Goal percentage, but, if awarded the Contract for this Project, commits to provide the percentage of the Contract award amount, indicated above, calculated as a portion of the Base Bid plus all accepted Alternates, by using EDGE-certified Business(es).

The Bidder acknowledges it understands the requirement for it to provide and agrees to provide to the Contracting Authority, if selected for consideration of the Contract, within 3 business days after notice from the Contracting Authority, a detailed Demonstration of Good Faith form describing its efforts undertaken prior to submitting its Bid to meet the advertised EDGE Participation Goal percentage for the Contract for this Project.

The Bidder commits to provide to the Contracting Authority at the location required, and within 3 days after receiving notice from the Contracting Authority, its fully completed Bidder's Qualifications Form, including an EDGE Affidavit form for each EDGE-certified Business proposed for use by the Bidder if awarded the Contract for this Project.

Option C

The Bidder declares that the Bidder is an EDGE-certified Business and that if awarded this Contract, the EDGE Participation percentage will be 100 percent of the Contract award amount.

Select EDGE option above*

Choices…

If option B selected, enter percentage

Certifications (State Prevailing Wages)

1. The Bidder has read and understands the proposed Contract Documents and agrees to comply with all requirements of the proposed Contract Documents, regardless of whether the Bidder has actual knowledge of the requirements and regardless of any statement or omission made by the Bidder, which might indicate a contrary intention.

2. The Bidder represents that the Bid is based upon the Basis of Design and Acceptable Components specified by the proposed Contract Documents.

3. The Bidder has visited the Site, become familiar with local conditions, and has correlated personal observations about the requirements of the proposed Contract Documents. The Bidder has no outstanding questions regarding the interpretation or clarification of the proposed Contract Documents.

4. The Bidder understands that the execution of the Project will require sequential, coordinated, and interrelated operations, which may involve interference, disruption, hindrance, or delay in the progress of the Bidder's Work. The Bidder agrees that the Contract Sum, as amended from time to time, shall cover all amounts due from the State resulting from interference, disruption, hindrance, or delay that is not caused by the State or its agents and employees. The Bidder agrees that any such interference, disruption, hindrance, or delay is within the contemplation of the Bidder and the State and that the Contractor's sole remedy from the State for any such interference, disruption, hindrance, or delay shall be an extension of time in accordance with the proposed Contract Documents.

5. During the performance of the Contract, the Bidder agrees to comply with Ohio Administrative Code ("OAC") Chapters 123:2-3 through 123:2-9 and agrees to incorporate the monthly reporting provisions of OAC Section 123:2-9-01 into all subcontracts on the Project, regardless of tier. The Bidder understands the State's Equal Opportunity Coordinator or the Contracting Authority may conduct pre-award and post-award compliance reviews to determine if the Bidder maintains nondiscriminatory employment practices, maintains an affirmative action program, and is exerting good faith efforts to accomplish the goals of the affirmative action program. For a full statement of the rules regarding Equal Employment Opportunity in the Construction Industry, see OAC Chapters 123:2-1 through 123:2-9.

6. The Bidder and each Person submitting a Bid on behalf of the Bidder certifies, and in the case of a Bid by a joint venture each member thereof certifies as to such member's entity, under penalty of perjury, that to the best of the undersigned's knowledge and belief: (a) the Base Bid, any Unit Prices, and any Alternate bid in the Bid have been arrived at independently without collusion, consultation, communication or agreement, for the purpose of restricting competition as to any matter relating to such Base Bid, Unit Prices or Alternate bid with any other Bidder; (b) unless otherwise required by law, the Base Bid, any Unit Prices and any Alternate bid in the Bid have not been knowingly disclosed by the Bidder and shall not knowingly be disclosed by the Bidder prior to the bid opening, directly or indirectly, to any other Bidder who would have any interest in the Base Bid, Unit Prices, or Alternate bid; (c) no attempt has been made or shall be made by the Bidder to induce any other Person to submit or not to submit a Bid for the purpose of restricting competition.

7. The Bidder shall execute the Agreement with the Contracting Authority, if a Contract is awarded on the basis of this Bid, and if the Bidder does not execute the Agreement for any reason, other than as authorized by law, the Bidder and the Bidder's Surety are liable to the State as provided in Article 5 of the Instructions to Bidders.

8. The Bidder certifies that the upon the award of a Contract, as the Contractor it shall make a good faith effort to ensure that all of the Contractor's employees, while working on the Site, shall not purchase, transfer, use, or possess illegal drugs or alcohol or abuse prescription drugs in any way.

9. The Bidder acknowledges that it read all of the Instructions to Bidders, and in particular, Section 2.10 - Submittals With Bid Form, and by submitting its Bid certifies that it has read the Instructions to Bidders and it understands and agrees to the terms and conditions stated in them.

10. The Bidder agrees to furnish any information requested by the Contracting Authority or the Architect/Engineer to evaluate the responsibility of the Bidder.

11. The Bidder agrees to furnish the submittals required by Section 6.1 of the Instructions to Bidders for execution of the Agreement within 10 days of the date of the Notice of Intent to Award.

12. When the Bidder is a corporation, partnership or sole proprietorship, an officer, partner or principal of the Bidder, as applicable, shall enter the legal name of the Bidder and the name of the officer, partner or principal of the Bidder (in lieu of signing the Bid Form) in the data fields provided.

13. When the Bidder is a joint venture, an officer, partner or principal, as applicable, of each member of the joint venture shall enter the legal name of the applicable member and the name of the officer, partner or principal (in lieu of signing the Bid Form) in the data fields provided.

14. The Bidder understands that the Contract is subject to all the provisions, duties, obligations, remedies and penalties of Ohio Revised Code Chapter 4115 and that the Bidder shall pay any wage increase in the locality during the term of the Contract.

15. The Bidder represents that the individual that is submitting and digitally signing the electronic Bid is legally authorized to do so.

16. Bidder acknowledges that by the act of submitting an electronic Bid that it is digitally signing the actual Bid, which shall serve as the Bidder's authorization for the further consideration and activity in the bidding and contract process.

☐ The Bidder hereby acknowledges that the above representations in this Bid are material and not mere recitals.*

☐ The Bidder hereby acknowledges that the above representations in this Bid are material and not mere recitals.*

Procurement Forms

Document 00 43 13 - Bid Security Form
→ Upload below and provide original document within 3 days

Document 00 45 13 - Bidder's Qualifications
→ Upload below or provide within 3 days of request

Document 00 45 39 - EDGE Affidavit
→ Upload below or provide within 3 days of request

3 Attachments

Instructions for Providing Bid Submittals

Submission of Electronic Facsimile of Bid Guaranty with Electronic Bid

The Bidder SHALL UPLOAD and ATTACH TO ITS BID an ELECTRONIC FACSIMILE (scanned PDF document) OF ITS BID GUARANTY, payable to the Contracting Authority, in the form of either: (1) the signed and sealed Document 00 43 13 - "Bid Security Form" contained in the Contract Documents (and provided for the Bidder's convenience in the block above) for the amount of the Base Bid plus all additive Alternates; or (2) a certified check, cashier's check, or letter of credit, for 10 percent of the Base Bid, plus all additive Alternates – a letter of credit shall expressly provide that it is revocable only by the Contracting Authority. Refer to Sections 2.10.1.1 and 5.1 of Document 00 21 13 - "Instructions to Bidders."

Submission of Original Bid Guaranty

In addition to the Electronic Facsimile above, the Bidder SHALL DELIVER ITS ORIGINAL UNALTERED BID GUARANTY to the Project Coordinator at the address identified below WITHIN 3 BUSINESS DAYS AFTER THE BID DEADLINE as provided in Ohio Administrative Code Section 153:1-8-01(H). THIS REQUIREMENT APPLIES TO ALL BIDDERS. Refer to Section 2.10.1.2 of the Instructions to Bidders.

Ohio Facilities Construction Commission
Sylvia Slivo
30 West Spring Street, 4th Floor,
Columbus, OH 43215

Required Bid Guaranty Upload

Name	File*
Document 00 43 13 - Bid Security Form → Upload a scan of the fully executed Bid Security Form AND submit the original document to the Contracting Authority within 3 days of the bid deadline	Select file... no file selected ☐ I am NOT enclosing this document because the omission terms have been met. (Bidder submitted a Cashier's check below)
Power of Attorney → Upload a scan of the fully executed Power of Attorney AND submit the original document to the Contracting Authority within 3 days of the bid deadline	Select file... no file selected ☐ I am NOT enclosing this document because the omission terms have been met. (Bidder submitted a Cashier's check below OR included with the Bid Security Form above)
Cashier's Check for 10% of the Bid → Upload a scan of the Cashier's Check AND submit the original check to the Contracting Authority within 3 days of the bid deadline	Select file... no file selected ☐ I am NOT enclosing this document because the omission terms have been met. (Bidder submitted the Bid Security Form AND Power of Attorney above)

3 Required Documents

Bidder's Qualifications and EDGE Affidavit Upload

Name	File*
Document 00 45 13 - Bidder's Qualifications → Upload fully completed form and attachments	Select file... no file selected ☐ I am NOT enclosing this document because the omission terms have been met. (Must be submitted to the Contracting Authority within 3 days of request)
Document 00 45 39 - EDGE Affidavit → Upload a completed form for each EDGE business	Select file... no file selected ☐ I am NOT enclosing this document because the omission terms have been met. (Must be submitted to the Contracting Authority within 3 days of request)

2 Required Documents

Bidder Signatory Information

Bidder Signatory

Name of Bidder's Authorized Signatory:*

Title of Authorized Signatory:*

All Bidders complete all information in this form. Duplicate and complete the block below for each Joint Venturer:

Bidder Information

Business Name:*

Business Mailing Address, City, State, Zip:*

Telephone Number:*

Facsimile Number:

Email Address:*

Federal Tax ID Number:*

State of Incorporation (if applicable):

Contact person for Contract processing:*

Date enrolled in an OBWC-approved DFSP (month/date/year):

President or Chief Executive Officer's Name:*

President or Chief Executive Officer's Title:*

END OF DOCUMENT

Document 00 43 13 - Bid Security Form
State of Ohio Standard Requirements for Public Facility Construction

(Form of combined Bid Guaranty and Bond prescribed by Ohio Revised Code Section 153.571)

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned _____

_____, as Principal,

and _____ as Sureties,

are hereby held and firmly bound unto _____

_____ as Obligee(s), in the penal sum of the dollar amount of the Bid submitted by the Principal

to the Obligee on _____ (date) to undertake the Project known as:

Project Number: _____

Project Name: _____

Contract Description: _____
(e.g., General Contractor/Trades, Plumbing, HVAC, Electrical)

The penal sum, referred to herein, shall be the dollar amount of the Principal's Bid to the Obligee, incorporating any additive alternate Bids made by the Principal on the date referred to above to the Obligee, which are accepted by the Obligee. In no case shall the penal sum exceed the amount of dollars ($_____). (If the preceding line is left blank, the penal sum will be the full amount of the Principal's Bid, including add alternates. Alternatively, if completed, the amount stated shall not be less than the full amount of the Bid, including Alternates, in dollars and cents. A percentage is not acceptable.) For the payment of the penal sum well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that whereas the above-named Principal has submitted a Bid for the above referenced Project;

NOW, THEREFORE, if the Obligee accepts the Bid of the Principal, and the Principal fails to enter into a proper contract in accordance with the Bid, Plans, Specifications, details, and bills of material; and in the event the Principal pays to the Obligee the difference, not to exceed ten percent of the penal sum hereof between the amount specified in the Bid and such larger amount for which the Obligee may in good faith contract with the Bidder determined by the Obligee to be the next lowest responsive and responsible to perform the Work covered by the Bid; or in the event the Obligee does not award the Contract to such next lowest responsive and responsible Bidder and resubmits the Project for bidding, the Principal pays to the Obligee the difference not to exceed ten percent of the penal sum hereof between the amount specified in the Bid, or the costs, in connection with the resubmission, of printing new Contract Documents, required advertising and printing and mailing notices to prospective Bidders, whichever is less, then this obligation shall be null and void, otherwise to remain in full force and effect. If the Obligee accepts the Bid of the Principal, and the Principal, within 10 days after the awarding of the Contract, enters into a proper contract and executes the Agreement Form in accordance with the Contract Documents, including without limitation the Bid, Plans, Specifications, details, and bills of material, which said Contract is made a part of this Bond the same as though set forth herein; and

NOW ALSO, IF THE SAID Principal shall well and faithfully perform each and every condition of such Contract; and indemnify the Obligee against all damage suffered by failure to perform such Contract according to the provisions thereof and in accordance with the Contract Documents, including without limitation Plans, Specifications, details, and bills of material therefore; and shall pay all lawful claims of Subcontractors, Material Suppliers and laborers for labor performed and materials furnished in the carrying forward, performing or completing of said Contract; we, agreeing and assenting that this undertaking shall be for the benefit of any Subcontractor, Material Suppliers or laborer having a just claim, as well as for the Obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

THE SAID Surety hereby stipulates and agrees that no modifications, omissions or additions, in or to the terms of said Contract, the Work thereunder or the Contract Documents, including without limitation the Plans and Specifications, therefore, shall in any way affect the obligations of said Surety on its bond, and it does hereby waive notice of any such modifications, omissions or additions in or to the terms of the Contract, the Work, or the Contract Documents, including without limitation the Plans and Specifications.

SIGNED AND SEALED this _____ day of _____ , _____ .

PRINCIPAL:

_____
Signature

By: _____
Name

_____
Title

SURETY:

_____
Signature

By: _____
Attorney-in-Fact

SURETY INFORMATION:

_____
Name

_____
Address 1

_____
Address 2

_____
City State Zip

_____
Telephone

_____
Email

SURETY AGENT'S INFORMATION:

_____
Name

_____
Address 1

_____
Address 2

_____
City State Zip

_____
Telephone

_____
Email

END OF DOCUMENT

Document 00 45 13 - Bidder's Qualifications
State of Ohio Standard Requirements for Public Facility Construction

Project Number: DRC-23L009

Project Name: LoCI Auto School Building

1. **Company Name**: _____

   Physical Address: _____
   Street, Building, Unit

   _____
   City, State, Zip

   Mailing Address (if different): _____
   P.O. Box

   _____
   City, State, Zip

   Telephone Number (w/ Area Code): (_____) _____

   Fax Number (w/ Area Code): (_____) _____

   Email address: _____

2. **Overall Experience.** Indicate Bidder's overall experience performing the trades bid, including the years in business performing the trade under present and former business names.

3. **Financial.** The apparent low Bidder shall submit, upon request of the Contracting Authority, either:

   a) An annual financial statement prepared within the 12 months prior to the bid opening by an independent licensed accounting firm; and the name, address, contact person and phone number of the bank normally used by the Bidder for its primary banking; or,

   b) A financial report generated within 30 days prior to the bid opening from Standard and Poor, Dun and Bradstreet or a similar company acceptable to the Contracting Authority documenting the financial condition of the Bidder; and the name, address, contact person and phone number of the bank normally used by the Bidder for its primary banking;

   This information is not a public record under Ohio Revised Code Section 149.43; and shall remain confidential, except under proper order of a court.

4. **Facilities & Equipment**. Indicate Bidder's relevant facilities and major equipment (leased or owned).

5. **Ongoing & Relevant Projects.** List all ongoing projects and projects completed in the last 5 years, which are similar in cost and type to the Project. Include scope of Work, Contract value, a description of EDGE participation and performance, and project name/contact person/address/phone number for each owner and the architect or engineer for each project.

6. **Regulatory / Contractual.** Indicate all occurrences of the following in the last 5 years (indicate if none). For verification, attach documentation, and/or provide sufficient and appropriate detail information such as: project name, owner, contact person and phone number, amount of contract, etc.

    a) State or federal Prevailing Wage violations or judgments

    b) Affirmative Action and EDGE program violations (Attach Certificate of Compliance with Affirmative Action Programs, issued pursuant to Ohio Revised Code Section 9.47)

    c) Contract abandonment, contract termination, as either a prime- or sub-contractor, or Surety takeover

    d) Debarment by state, federal, or local jurisdictions

e) EPA/OSHA violations

f) Liquidated damages and Statutory Delay Forfeiture assessed

g) Drug-Free Safety Program and Drug Free Workplace Program violations

7. Management. Identify individuals assigned to this Project.

Principal _____ Years with firm _____ Total Exp._____

Project Manager _____ Years with firm _____ Total Exp._____

Field Superintendent _____ Years with firm _____ Total Exp._____

8. EDGE Participation. Identify EDGE-certified Business Enterprises proposed as Subcontractors and Material Suppliers for this Project. Attach a fully completed Document 00 45 39 - "EDGE Affidavit" for each EDGE-certified Business Enterprise.

9. Certification. I hereby certify that the information in this entire Bidder's Qualifications form, including all attachments and referenced information, is factual and complete.

Company Name _____

Authorized Official (please print or type) _____

Signature of Authorized Official _____ Date _____

END OF DOCUMENT

Document 00 45 39 - EDGE Affidavit
State of Ohio Standard Requirements for Public Facility Construction

EDGE PARTICIPATION

Certified Statement of Intent to Contract and Perform

Bidder or Proposer: Submit one fully completed form for each EDGE-certified Business

Project: DRC-23L009

Project Name: LoCI Auto School Building

A. Bidder or Proposer's Company Name: _____

Mark all that apply:

☐ Multi-Prime Contract ☐ General Contract ☐ CM at Risk Contract ☐ Design-Build Contract

B. EDGE-certified Business information (for contract at ANY tier)

Mark all that apply:

☐ Subcontractor ☐ Material Supplier ☐ Professional Services ☐ Goods & Services

EDGE Business Name: _____

EDGE Business Address: _____

_____

EDGE Certification Number: _____ E-mail: _____

Contact Person: _____ Phone: _____

Insert detailed description of materials, labor, services, supplies, etc. (may use industry codes – continue on separate page):

_____

_____

_____

C. Certification of Intent

By signing below, the Bidder or Proposer certifies that it intends to contract with the EDGE-certified Business for the portion of the contract described above related to its Contract for this Project and for the estimated cost shown below. By signing below, the EDGE-certified Business certifies that it intends to contract with the Bidder or Proposer and intends to provide the portion of the contract described above related to the Contract for this Project for the estimated cost of:

_____ and _____ /100 dollars ($_____).

In the event the named Bidder or Proposer is NOT awarded a Contract, this Statement shall be null and void.

EDGE-certified Business	***Bidder or Proposer***
_____	_____
Authorized Signature	Authorized Signature
_____	_____
Name and Title	Name and Title
_____	_____
Date Signed	Date Signed

END OF DOCUMENT

Document 00 52 00 - Agreement Form
State of Ohio Standard Requirements for Public Facility Construction

This Agreement is made as of the date set forth below between the State of Ohio, acting by and through the Contracting Authority, and the Contractor in connection with the Project.

Project Number:	DRC-23L009
Project Name:	LoCI Auto School Building
Site Address:	1580 OH-56 London, OH 43140
Owner:	Lorain Correctional Institution
Owner's Representative:	Jeremy Hyer Ohio Department of Rehabilitation & Correction
Address:	PO Box 430 Columbus Ohio 43216
Contracting Authority:	Ohio Facilities Construction Commission
Project Manager:	Michael Covault
Address:	30 West Spring Street, 4th Floor, Columbus, OH 43215
Contractor:	**TBD**
Contractor's Principal Contact:	TBD
Address:	TBD
Architect/Engineer ("A/E"):	**Glaus, Pyle, Schomer, Burns & Dehaven, Inc. dba. GPD Group**
A/E's Principal Contact:	Rick DeMarco
Address:	1228 Euclid Avenue, Suite 320 Cleveland, OH 44115

ARTICLE 1 - SCOPE OF WORK; EDGE COMMITMENT

1.1 The Contractor shall perform and provide all of the Work described in the Contract.

1.2 The project delivery method for this Project shall be «insert project delivery method».

1.3 The Contractor shall contract with EDGE-certified Business(es) for not less than «insert Contractor's EDGE commitment» percent of the Contract Sum.

ARTICLE 2 - COMPENSATION

2.1 The Owner shall pay the Contractor the Contract Sum for the Contractor's proper, timely, and complete performance of the Contract. The Contract Sum is **$«insert amount»**, subject to Modifications as provided in the Contract Documents. The Contract Sum is comprised of the following:

2.1.1 Base Bid: .....$«Insert Base Bid Amount»

2.1.2 Alternate «Insert Alternates Awarded»: .....$«Insert Alternate Amount»

2.1.3 Alternate «Insert Alternates Awarded»: .....$«Insert Alternate Amount»

2.1.4 Alternate «Insert Alternates Awarded»: .....$«Insert Alternate Amount»

2.1.5 Alternate «Insert Alternates Awarded»: .....$«Insert Alternate Amount»

ARTICLE 3 - CONTRACT TIMES

3.1 The Contract Times are the periods established in the following table for the achievement of the associated Milestones:

Construction Stage Milestone(s) to which Liquidated Damages apply	**Contract Time**	**Projected Date** (as of the date of this Agreement)
Substantial Completion of all Work	-	-

3.1.1 The projected dates listed under "Projected Date (as of the date of this Agreement)" are provided only for convenient reference during consideration of the Agreement. The durations listed under "Contract Time" define the Contract Times and take precedence over the projected dates.

ARTICLE 4 - KEY PERSONNEL

4.1 The Contractor's key personnel for the Project are:

4.1.1 «insert name», Project Manager;

4.1.2 «insert name», Lead Scheduling Engineer;

4.1.3 «insert name», General Superintendent.

4.2 The Contractor's key personnel are authorized to act on the Contractor's behalf with respect to the Project and all matters concerning the Project.

ARTICLE 5 - GENERAL PROVISIONS

5.1 Effectiveness.

5.1.1 It is expressly understood by the Contractor that none of the rights, duties, and obligations described in the Contract Documents shall be valid and enforceable unless the Director of the Office of Budget and Management first certifies that there is a balance in the Owner's appropriation not already encumbered to pay existing obligations and until all relevant statutory provisions of the Ohio Revised Code, including ORC Section 126.07, have been complied with, and until such time as all necessary funds are available or encumbered and, when required, such expenditure of such funds is approved by the State Controlling Board, or other applicable approving body.

5.1.2 In addition, if federal funds are to be used to pay fees and expenses under this Agreement, none of the rights, duties, and obligations contained in this Agreement shall be binding on any party until the Owner gives the Contractor written notice that such funds are available from the Owner's funding source.

5.1.3 Subject to **Section 5.1.1**, the Contract shall become binding and effective upon execution by the Contracting Authority, Owner, Contractor, and Ohio Attorney General.

5.1.3.1 If the Contractor is a joint venture, **(1)** each individual joint venturer shall **(a)** sign the Agreement in its own name and **(b)** be a party to the Contract, and **(2)** the Contract and the Performance and Payment Bond shall be binding on and apply to all joint venturers jointly and severally.

5.1.3.2 If the Contractor is a limited liability company, which the Contracting Authority reasonably believes to be a special purpose or similar entity, the Contracting Authority may in its discretion require the limited liability company and each member of the limited liability company to **(1)** sign the Agreement in its own name and **(2)** be a party to the Contract. In that case, the Contract and the Performance and Payment Bond shall be binding on and apply to the limited liability company and to all of its members jointly and severally.

5.1.4 This Agreement may be executed in several counterparts, each of which shall constitute a complete original Agreement, which may be introduced in evidence or used for any other purpose without production of any other counterparts.

5.2 Representations.

5.2.1 The Contractor represents and warrants that it is not subject to an unresolved finding for recovery under ORC Section 9.24. If this representation and warranty is found to be false, the Contract is void, and the Contractor shall immediately repay to the Owner any funds paid under this Contract.

5.2.2 The Contractor hereby certifies that neither the Contractor nor any of the Contractor's partners, officers, directors, shareholders nor the spouses of any such person have made contributions in excess of the limitations specified in ORC Section 3517.13.

5.2.3 The Contractor, by signature on this Agreement, certifies that it is currently in compliance with, and will continue to adhere to, the requirements of Ohio ethics laws and conflict of interest laws and will take no action inconsistent with those laws.

5.2.4 The Contractor affirms to have read and understands Executive Order 2019-12D and shall abide by those requirements in the performance of this Contract. Notwithstanding any other terms of this Contract, the State reserves the right to recover any funds paid for services the Contractor performs outside of the United States for which it did not receive a waiver. The State does not waive any other rights and remedies provided the State in this Contract.

5.2.5 The Contractor affirms to have read and understands Executive Order 2022-02D regarding the prohibition of purchases from or investment in a Russian institution or company and shall abide by those requirements in the performance of this Contract. Notwithstanding any other terms of this Contract, the State reserves the right to recover any funds paid to the Contractor for purchases or investments in a Russian institution or company in violation of this paragraph. The provisions of this paragraph will expire when the applicable Executive Order is no longer effective.

5.2.6 During the performance of this Contract, if the Contractor changes the location(s) disclosed on the **Affirmation and Disclosure Form** (a page in its **Bid Form**), the Contractor must complete and submit a revised **Affirmation and Disclosure Form**.

5.2.7 Pursuant to ORC Section 9.76(B), the Contractor warrants that it is not boycotting any jurisdiction with whom the State of Ohio can enjoy open trade, including Israel, and will not do so during the term of this Contract.

ARTICLE 6 - Enumeration of Documents

6.1 The Contract Documents constitute the substance of the Contract, and include this Agreement, Drawings, Specifications, Addenda if any, **Contracting Definitions**, **General Conditions**, Supplementary Conditions if any, **Bid Form**, **Wage Rate Requirements**, **Bid Guaranty and Contract Bond** or **Performance and Payment Bond**, and Change Orders if any.

TREASURER'S CERTIFICATION

This signature certifies the amount required to meet the obligation in the fiscal year in which this Agreement is made has been lawfully appropriated for such purpose and is in the treasury or in process of collection to the credit of an appropriate fund free from any previous encumbrances.

_____
Signature

_____
Printed Name
Chief Financial Officer

SIGNATURES

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date set forth below:

«INSERT CONTRACTOR'S NAME»	**STATE OF OHIO**
_____	_____
Signature	*Signature*
_____	_____

Printed Name

Title

OWNER'S CONCURRENCE
by «insert Owner's name»

Signature

Printed Name

Title

Printed Name

Title

OHIO ATTORNEY GENERAL
Approval as to Form

Signature

Printed Name

Title

Date

«INSERT CONTRACTOR'S NAME»
by «insert Joint Venturer/Member's name»

Signature

Printed Name

Title

by «insert Joint Venturer/Member's name»

Signature

Printed Name

Title

STATE OF OHIO
by «insert Contracting Authority's name»

Signature

Printed Name

Title

OWNER'S CONCURRENCE
by «insert Owner's name»

Signature

Printed Name

Title

OHIO ATTORNEY GENERAL
Approval as to Form

Signature

Printed Name

Title

Date

END OF DOCUMENT

Document 00 52 14 - State of Ohio Subcontract Form
State of Ohio Standard Requirements for Public Facility Construction

This Agreement is made as of the date set forth below between the Contractor and the Subcontractor in connection with the Project.

Project Number:	DRC-23L009
Project Name:	LoCI Auto School Building
Site Address:	1580 OH-56 London, OH 43140
Contractor:	**TBD**
Contractor's Principal Contact:	TBD
Address:	TBD
Subcontractor:	**TBD**
Subcontractor's Principal Contact:	TBD
Address:	TBD
Public Authority:	**Ohio Facilities Construction Commission**
Public Authority Contact:	Michael Covault
Address:	PO Box 430 Columbus Ohio 43216

ARTICLE 1 - NATURE OF SUBCONTRACT

1.1 The Subcontractor shall perform the entire Subcontract Work as specified in Exhibit «N» and described in the Contract Documents for the Project.

ARTICLE 2 - COMPENSATION

2.1 The Contractor agrees to pay for the performance of this Subcontract, subject to additions and deductions as provided in the Contract Documents, the Subcontract Sum of «insert Subcontract Sum», comprised of the following:

«insert Subcontract Sum component» ..... $«insert amount»

«insert Subcontract Sum component» ..... $«insert amount»

«insert Subcontract Sum component» ..... $«insert amount»

«insert Subcontract Sum component» ..... $«insert amount»

ARTICLE 3 - TIME OF PERFORMANCE

3.1 Time is of the essence. The Subcontractor shall diligently prosecute and complete all Subcontract Work in accordance with the construction progress schedule agreed between the parties.

ARTICLE 4 - CONTRACT DOCUMENTS

4.1 To the extent that the contract between the Public Authority and the Contractor applies to the Subcontract Work:

4.1.1 The Contractor and the Subcontractor agree to be mutually bound by the terms of the Contract Documents;

4.1.2 The Contractor assumes toward the Subcontractor the rights, remedies, obligations, and responsibilities that the Public Authority has and assumes toward the Contractor;

4.1.3 The Subcontractor assumes toward the Contractor the rights, remedies, obligations, and responsibilities that the Contractor assumes toward the Public Authority; and

4.1.4 The Subcontractor agrees to perform its portion of the Work in accordance with the Contract Documents.

4.2 The Subcontract and any modifications, amendments, or alterations thereto shall be governed, construed, and enforced by and under the laws of the State of Ohio.

4.3 If any term or provision of the Subcontract, or the application thereof to any Person or circumstance, is finally determined, to be invalid or unenforceable by a court of competent jurisdiction, the remainder of the Subcontract or the application of such term or provision to other Persons or circumstances, shall not be affected thereby, and each term and provision of the Subcontract shall be valid and enforced to the fullest extent permitted by law.

4.4 The Subcontract shall be binding on the Contractor and Subcontractor, their successors and assigns, in respect to all respective covenants and obligations contained in the Contract Documents, but the Subcontractor may not assign the Subcontract without the prior written consent of the Contractor and the Public Authority.

ARTICLE 5 - EFFECTIVENESS

5.1 The Subcontract shall become binding and effective upon execution by the Contractor.

5.2 This Subcontract has been executed in several counterparts, each of which shall constitute a complete original Subcontract, which may be introduced in evidence or used for any other purpose without production of any other counterparts.

5.3 Any signatory may deliver a copy of its counterpart signature page to this Subcontract via fax or e-mail. Each signatory shall be entitled to rely upon a signature of any other signatory delivered in such a manner as if such signature were an original.

ARTICLE 6 - REPRESENTATIONS

6.1 Contingent Assignment. The Contractor's contingent assignment of this Subcontract to the Public Authority, as provided in the Contract, is effective after termination of the Contractor by the Public Authority and the Public Authority's acceptance of the assignment in writing to the Subcontractor. The Subcontractor consents to the assignment and shall be bound at the same price and terms as in the Subcontract to the Public Authority. Unless the Public Authority takes assignment of the Subcontract, the Subcontractor will not have any contractual rights against the Public Authority.

6.2 Intended Third-Party Beneficiary. The Public Authority is an intended third party beneficiary of the Subcontract, entitled to enforce any rights thereunder for its benefit.

6.3 Insurance. The Subcontractor shall maintain insurance in accordance with the Contract Documents. Exhibit «N» sets forth the minimum limits of liability for the insurance required in the Contract Documents.

6.4 Right to Audit. The Subcontractor agrees that the Public Authority or any agents designated by the Public Authority have access to and the right to audit and the right to copy at the Public Authority's cost all of the Subcontractor's books, records, contracts, correspondence, instructions, drawings, receipts, vouchers, purchase orders, and memoranda relating to the Work for a period of not less than 3 years following completion of the Work consistent with Ohio Revised Code ("ORC") Section 149.43 with regard to the Public Authority's obligation to maintain confidentiality of trade secrets.

6.5 Indemnity. To the fullest extent permitted by law, the Subcontractor shall indemnify, defend, and hold harmless the Public Authority, the Contractor, their consultants and employees from all claims and expenses for bodily injury and property damage other than to the Work itself that may arise from the performance of the Subcontract Work, including reasonable attorneys' fees, costs and expenses, but only to the extent caused by the negligent acts or omissions of the Subcontractor or a person or entity for whom the Subcontractor may be liable. This Subcontract does not require a Subcontractor to waive its immunity under the Workers Compensation laws of Ohio from claims brought against the Subcontractor by the Subcontractor's employees.

6.6 Prompt Pay. The Contractor shall at a minimum make payments to the Subcontractor in accordance with Applicable Law, including ORC Section 4113.61. Progress payments to the Subcontractor for satisfactory performance of Subcontract Work shall be made no later than 10 days after receipt by the Contractor of payment from the Public Authority for Subcontract Work.

6.7 Retainage. Subcontractor retainage shall be at a rate equal to the percentage retained from the Contractor's payment by the Public Authority for the Subcontract Work, unless a lesser percentage is otherwise specified.

6.7.1 Labor Payments.

6.7.1.1 Partial payments to the Subcontractor for labor performed shall be made at the rate of 92 percent of the amount invoiced through the Subcontractor's request for payment that shows the Work of the Subcontractor is 50 percent complete.

6.7.1.2 After the Work of the Subcontractor is 50 percent complete, as evidenced by payments of at least 50 percent of the total amount due under the Subcontract, no additional funds shall be retained from payments for labor.

6.7.2 Material Payments.

6.7.2.1 The Contractor shall pay the Subcontractor at the rate of 100 percent of the scheduled value for materials incorporated into the Project.

6.7.2.2 The Contractor shall pay the Subcontractor at the rate of 92 percent of the invoice cost, not to exceed the scheduled value, for materials delivered to the Site, or other off-site storage location approved by the A/E, provided the Subcontractor provides the following information with its request for payment:

.1 a list of the fabricated materials consigned to the Project, giving the place of storage, together with copies of invoices, in order to verify quantity and cost; and

.2 a certification of materials stored off-site, prepared by the Subcontractor and signed by the A/E to evidence that the materials are in conformity with the Specifications and have been tagged with the Project name and number for delivery to the Project. The Subcontractor shall reimburse the A/E, through the Contractor, for all costs incurred to visit a storage site, other than the areas adjacent to the Project.

.3 The Contractor shall pay the balance of the scheduled value when the materials are incorporated into and become a part of the Project.

6.8 Warranty. The Subcontractor fully warrants, for the benefit of the Public Authority, that all materials and equipment shall be new unless otherwise specified, of good quality, in conformance with the Contract Documents and free from defective workmanship or materials.

6.9 Non-Waiver of Lien Rights or Payment Bond Rights. This Subcontract shall not prohibit a Subcontractor from exercising its rights under ORC Chapter 1311 or under any Contractor-provided payment bond.

6.10 Non-Discrimination. The Subcontractor agrees to fully comply with Applicable Law regarding equal opportunity, including ORC Section 153.59 and, to the extent applicable, all Executive Orders issued by the Governor of the state of Ohio.

6.11 Dispute Resolution. The supplemental conditions to this Subcontract shall provide for a dispute resolution process comparable to the Contract's dispute resolution process in terms of timing, notice, substantiation, and informal dispute resolution efforts. The dispute resolution process provided in the supplemental conditions shall result in prompt access to the ultimate dispute resolution mechanism selected by the parties.

6.12 In the event that any supplemental conditions or other Subcontract terms conflict with the **State of Ohio Subcontract Form**, the **State of Ohio Subcontract Form** takes precedence and this Subcontract shall be read and enforced to include the provisions of the **State of Ohio Subcontract Form**.

6.13 The following exhibits are attached to and are a part of this Subcontract:

6.13.1 Exhibit A:

6.13.2 Exhibit B:

6.13.3 Exhibit C:

6.13.4 Exhibit D:

SIGNATURES

IN WITNESS WHEREOF, the parties have executed this Subcontract Form.

«INSERT SUBCONTRACTOR'S NAME»	«INSERT CONTRACTOR'S NAME»
Signature	*Signature*
Printed Name	*Printed Name*
Title	*Title*
	Date

END OF DOCUMENT

Document 00 61 13 - Performance and Payment Bond Form
State of Ohio Standard Requirements for Public Facility Construction

(Form of Bond prescribed by Ohio Revised Code Section 153.57 - Not to be used as Bid Guaranty)

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned _____ _____, as Principal, and _____ as Sureties, are hereby held and firmly bound unto _____ _____ as Obligee(s), in the penal sum of _____ dollars, for the payment of which well and truly to be made, we jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

SIGNED AND SEALED this _____ day of _____, _____.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that whereas the above-named Principal did on the _____ day of _____, _____, enter into a Contract with the Obligee, which said Contract is made a part of this Bond the same as though set forth herein and which is more fully described as:

Project Number: _____

Project Name: _____

Contract Description: _____
(e.g., General Trades, Plumbing, HVAC, Electrical)

NOW, THEREFORE, if the above-named Principal shall well and faithfully do and perform the things agreed by the Obligee to be done and performed according to the terms of said Contract; and shall pay all lawful claims of Subcontractors, Material Suppliers, and laborers, for labor performed and materials furnished in the carrying forward, performing, or completing of said Contract; we agreeing and assenting that this undertaking shall be for the benefit of any Subcontractor, Material Supplier or laborer having a just claim as well as for the Obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the Sureties for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

THE SAID Surety hereby stipulates and agrees that no modifications, omissions, or additions, in or to the terms of the said Contract or in or to the Plans and Specifications therefor shall in any wise affect the obligations of said Surety on its bond, and it does hereby waive notice of any such modifications, omissions or additions in or to the terms of the Contract, the Work or the Contract Documents, including without limitation the Plans and Specifications.

PRINCIPAL:

_____
Principal Signature

By: _____

Title: _____

SURETY:

_____
Surety Signature

By: _____
Attorney-in-Fact

SURETY INFORMATION:

_____
Street

_____
City State Zip

_____
Telephone Number

SURETY AGENT'S INFORMATION:

_____
Agency Name

_____
Street

_____
City State Zip

_____
Telephone Number

_____
Email Address

END OF DOCUMENT

Exhibit D

Acceptable Component — A component listed in the Specifications after the Basis of Design Component.

Addenda or Addendum — Written or graphic instrument issued prior to the bid opening which modifies or interprets the proposed Contract Documents by additions, deletions, clarifications, or corrections. Addenda become part of the Contract Documents when the Agreement is executed.

A/E — See "Architect/Engineer."

Agreement — The form furnished by the Contracting Authority (including all of its exhibits) that, when completed and signed by the Contractor and Contracting Authority evidences entry into the Contract.

Allowance — A sum stipulated in the Contract Documents for a defined scope of the Work that may not be completely defined at the time of bidding. Allowance amounts do not include the Contractor's Fee on account of the associated Work.

Alternate — A change in the proposed Project scope, which may include but is not limited to alternate materials or methods of construction, and an amount stated on the Bid form to be added to or deducted from the Base Bid if the corresponding Alternate is incorporated into the Contract.

Alternative Dispute Resolution — A voluntary and non-binding process for the administrative review, consideration, and attempted settlement of a dispute, without resort to judicial process, including but not limited to partnering, negotiation, mediation, impartial fact-finding, dispute review board, and mini-trials, but shall not include arbitration.

Applicable Law — All federal, state, and local codes, statutes, ordinances, and regulations that apply to the performance of the Work or the A/E's Services on the Project.

Architect/Engineer — The Person responsible for providing professional design services and construction contract administration for the Project as provided in the Contract Documents. The A/E shall be a **(1)** registered architect holding a license and certificate of authorization issued by the Ohio Architects Board pursuant to ORC Chapter 4703, **(2)** landscape architect holding a license and certificate of authorization issued by the Ohio Landscape Architects Board pursuant to ORC Chapter 4703, or **(3)** professional engineer or professional surveyor holding a license and certificate of authorization issued by the Ohio Engineers and Surveyors Board pursuant to ORC Chapter 4733.

As-Built Documents — Documents, including but not limited to Drawings, Addenda, Specifications, executed Change Orders, and other elements of the Contract Documents which the Contractor annotates and otherwise modifies to indicate changes made during the construction process, the location of concealed and buried items, and other information useful to the Owner throughout the life of the completed Project.

Base Bid — The amount stated in a Bid as the sum for which the Bidder offers to perform the Work in a particular trade or other category, which is described in the Contract Documents, excluding Alternates.

Basis of Design — A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

Basis of Design Component — A component listed first in the Specifications.

Bid — A written proposal to perform a Contract, submitted on a completed Bid Form, accompanied by other required documents. The term Bid includes a proposal that has been digitally signed, encrypted, and submitted through the State's electronic bidding application pursuant to OAC Section 153:1-8-01.

Bidder	A Person that submitted a Bid.
BIM	See "Building Information Model."
Bid Form	A form furnished by the Contracting Authority with the proposed Contract Documents that is to be completed, signed, and submitted containing the Bidder's Bid.
Bid Guaranty	A bid bond or other instrument of security authorized by ORC Section 153.54 submitted with the Bid to provide assurance that the Bidder will execute the Agreement.
Bond	A performance and payment bond in the format specified by ORC Section 153.57 submitted by the Contractor to provide assurance that the Contractor will perform the Work of the Contract, including making required payments to Subcontractors and Materials Suppliers.
Building Information Model	A digital representation of physical and functional characteristics of a facility; a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle, which is defined as existing from earliest conception to demolition; electronic files used to design and coordinate the Project; and may be used to describe a single model or multiple models used in the aggregate.
Certificate of Contract Completion	A form used to document that the Contractor's achievement of Contract Completion. This form may also be used to document partial Contract Completion.
Certificate of Substantial Completion	A form used to document **(1)** that the Contractor has achieved Substantial Completion of the Work or a designated portion of the Work for which the Contracting Authority and the Owner have agreed to take Partial Occupancy, and **(2)** the date on which the associated Substantial Completion of the Work was achieved.
Change Directive	A written document prepared by the A/E and executed by the Contracting Authority that directs a change in the Work.
Change Order	A document recommended by the A/E and executed by the Contracting Authority and the Contractor that modifies the Contract.
Claim	A demand or assertion, initiated by written notice, certified by one of the parties to the Contract seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time, or other relief with respect to the terms of the Contract.
Claim Affidavit	A sworn document used in conjunction with filing a lien, which contains a claim on the funds that are due to a Contractor, in favor of a Person supplying labor, materials, or services for the value of labor, materials, or services supplied.
Combined Bid	A Bid that combines bid items for separate Contracts stated on the Bid Form.
Commission	See "Ohio Facilities Construction Commission."
Commissioning Agent	The Person identified by the Contracting Authority who leads, plans, schedules, and coordinates the commissioning team to implement the Commissioning Process for the Project.
Commissioning Plan	A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.
Commissioning Process	A quality-focused process for enhancing the delivery of a project. The process focuses on verifying and documenting that the facility and all of its systems are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.

Commissioning Report	A document that records the activities and results of the Commissioning Process. The Commissioning Report is developed from the final Commissioning Plan with its attached appendices.
Conformed Documents	Contract Documents with all Addenda items and accepted Alternates incorporated by the A/E, published, and issued to a successful Bidder for its use during performance of the Contract. The Conformed Documents are furnished solely for the Contractor's convenience. In the event of any conflict between the Contract Documents modified by Addenda and the Conformed Documents, the Contract Documents take precedence.
Construction Budget	The amount identified in the Agreement as adjusted by the Owner and Contracting Authority.
Construction Cost	The sum of the Contract Cost amounts for a phase of the Project.
Construction Progress Schedule	The critical path schedule for performance of the Contract; showing the time for completing the Work within the Contract Times; the planned sequence for performing the various components of the Work; the interrelationship between the activities of the Contractor, A/E, Contracting Authority, and Owner; and the Contractor's resource and cost loading information; as periodically updated during the performance of the Work.
Contract	The state of legal obligation entered into by the State and the Contractor, whereby they have agreed to an exchange of certain acts, materials, equipment, and services for certain monetary consideration, under all terms and conditions specified in the Contract Documents, which shall remain in full force and effect until such time as all obligations under the Contract have been lawfully and completely discharged, or the Contract is terminated under other conditions specified in the Contract Documents.
Contract Completion	The schedule Milestone in the progress of any Phase when the Work is completed in accordance with the terms of the Contract Documents and Contractor has satisfied all of its other obligations under the Contract Documents, including but not limited to **(1)** all governmental authorities have given final, written approval of the Work, **(2)** a final unconditional certificate of occupancy has been granted and issued to the Owner by the appropriate governmental authorities, **(3)** the Contractor's Work is 100 percent complete, and **(4)** all Punch List items have been completed or corrected, and **(5)** the Contractor has complied with conditions precedent to final payment and release of retained funds.
Contract Documents	Collectively, the documents that constitute the substance of the Contract including but not limited to Drawings, Specifications, Addenda if any, General Conditions, Supplementary Conditions if any, Bid Form, Wage Rates; and the executed Agreement, Bid Guaranty and Contract Bond, and Change Orders if any.
Contract Sum	The Contract Sum is the Contractor's entire compensation for the Contractor's proper, timely, and complete performance of the Work and is subject to adjustment as provided in the Contract.
Contract Times	The periods stipulated in the Agreement for the achievement of associated Milestones, in consecutive days, beginning on the date established by the Notice to Proceed, including adjustments authorized by executed Change Orders.
Contracting Authority	The party identified in the Agreement, which may be the Ohio Facilities Construction Commission; an agency of the state of Ohio; an Institution of Higher Education or division thereof; a School District Board; or the legislative body of a political subdivision.
Contractor	A firm, which is party to the Contract for the performance of Work on the Project in accordance with the Contract Documents.
Contractor's Documents	All Project-related documents, including those in electronic form, prepared by the Contractor and its Subcontractors.

Contractor's Fee	The portion of the Contract Sum attributable to the aggregate of the Contractor's profit and home-office overhead related to the Contractor's proper, timely, and complete performance of the Work.
Contractor Payment Request	The form furnished by the Commission that is to be used by the Contractor in requesting payments and which, when signed by the Contractor, shall serve as an affidavit that payments requested are in proportion to the Work completed as shown on the Schedule of Values.
Contractor's Punch List	A document prepared by the Contractor that consists of a list of items of Work to be completed or corrected by the Contactor as a condition precedent to Contract Completion.
Coordination Drawings	Drawings and Electronic Files prepared by the Contractor to demonstrate how multiple-system and interdisciplinary work will be coordinated. Clash reports generated by BIM authoring software may be included in the Coordination Drawing submittals if applicable.
Correction Period	A period of one year commencing on the date of Substantial Completion of the Work or a designated portion of the Work which the Contracting Authority and Owner have agreed to take Partial Occupancy.
CxA	See "Commissioning Agent."
Date of Commencement	The date established in a Notice to Proceed issued by the Contracting Authority to the Contractor to mark the start of the Work and the beginning of the running of the Contract Times.
day	A calendar day of 24 hours measured from midnight to midnight, unless otherwise expressly specified to mean a business day.
Defective Work	Work that does not conform to the Contract Documents; or does not meet the requirements of any applicable statute, rule or regulation, inspection, reference standard, test or approval; or has been damaged prior to the A/E's recommendation of final payment, unless responsibility for the protection thereof has been expressly assumed by the Owner; or that is not free from defects in workmanship, materials or equipment during the period of any warranty or guarantee.
Differing Site Condition	Either **(1)** a subsurface or otherwise concealed physical condition encountered at the Site that differs materially from the conditions indicated in the Contract Documents or **(2)** an unknown physical condition of an unusual nature encountered at the Site that differs materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents.
Dispute Review Board	A form of Alternative Dispute Resolution that is typically comprised of three members, selected jointly by the Contractor and the Contracting Authority, to monitor the progress of construction and provide recommended resolutions to disputes that are brought before them.
Drawings	Graphic portions of the Contract Documents, showing the design, type of construction, location, dimension, and character of the Work to be provided by the Contractor, which generally includes plans, elevations, sections, details, schedules, diagrams, notes, and text.
Electronic File	Information maintained in a computer system or format that is intended to facilitate a Person's use and manipulation of the information including but not limited to Word, Excel, PDF, Primavera, CAD, and BIM files all in their native format.
Enclosure, Permanent	The condition in which the permanent exterior walls and roofs are in place, insulated and weathertight, and permanent windows and entrances are in place.
Enclosure, Temporary	The condition in which the permanent exterior walls and roofs are in place, insulated and weathertight, and windows and entrances are provided with suitable temporary enclosures.

Estimated Construction Cost	The sum of the Estimated Contract Cost amounts published in the Solicitation, as modified by Addenda, for a phase of the Project.
Estimated Contract Cost	The estimated amount for the Contract published in the Solicitation, including the Base Bid estimate and the estimates of selected Alternates, if any, as modified by Addenda.
Extra Materials	Materials required by the Contract Documents that are not incorporated into the Project but are given to the Owner to be used for future maintenance or repairs.
Final Inspection	The final review of the Work of the Contractor by the A/E to determine whether issuance of the Certificate of Contract Completion is appropriate.
furnish	Supply and deliver to the Site, or other specified location, ready for installation.
General Conditions	The State's Standard General Conditions currently in effect, which may be modified by the Commission from time to time.
General Conditions Costs	General Conditions Costs include only the Contractor's costs to provide the general conditions Work including without limitation the costs of all of the following Site-related items: scheduling and coordinating the Work. telephone, telephone charges, facsimile, telegrams, postage, photos, photocopying, hand tools, simple scaffolds (one level high), tool breakage, tool repairs, tool replacement, tool blades, tool bits, and pre-approved travel, lodging, and parking costs. General Conditions Costs also include **(1)** Bond premiums and **(2)** premiums for builder's risk insurance if the Contractor purchases the builder's risk policy for the Project.
Hazardous Materials	Any material, substance, pollutant, or contaminant that is defined, regulated, referenced, or classified in the Comprehensive Environmental Response, Compensation and Liability Act, Federal Water Pollution Control Act, the Resource Conservation and Recovery Act, Clean Air Act, Hazardous Materials Transportation Uniform Safety Act, Toxic Substances Control Act, or any other Applicable Law relating to any hazardous, toxic, or dangerous waste, substance, or material. Any substance or material that, after release into the environment or upon exposure, ingestion, inhalation, or assimilation, either directly from the environment or directly by ingestion through food chains, will, or may reasonably be anticipated to, cause death, disease, behavior abnormalities, cancer or genetic abnormalities and specifically includes but is not limited to asbestos, polychlorinated biphenyls ("PCBs"), radioactive materials, including radon and naturally occurring radio nuclides, natural gas, natural gas liquids, liquefied natural gas, synthetic gas, oil, petroleum and petroleum-based derivatives and urea formaldehyde.
Indemnified Parties	The State, Contracting Authority, Owner, A/E, other Separate Consultants, and their respective officials, officers, consultants, agents, representatives, and employees, in both individual and official capacities.
install	Put into use or place in final position, complete and ready for intended service or use.
Institutional Designee	The party identified in the Agreement empowered with a level of authority similar to the Executive Director of the Commission, which may be the university architect or engineer, director of capital facilities, or an institution vice president.
Institution of Higher Education	Any state of Ohio university or college, community college, state of Ohio community college, technical college, university branch, community college district, technical college district, university branch district, and the applicable board of trustees or, in the case of a university branch district, any other managing authority.
Liquidated Damages	A sum established in the Contract Documents, pursuant to the statutory delay forfeiture authorized under ORC Section 153.19, to be paid to the Owner due to the Contractor's failure to complete the Work within the Contract Time for achievement of Substantial Completion, or any applicable portion of the Work on or prior to any Milestone date stated on the Agreement.
Material Supplier	A Person under a contract with the Contractor to furnish materials or supplies in furtherance of the Work, including all such Persons in any tier. Material Supplier

	does not include any Separate Contractor unless expressly assigned in writing to the Contractor by the Owner and accepted by the Contractor.
mediation	A voluntary process in which a neutral third party meets with the parties who have a disagreement or dispute and attempts to facilitate a mutually satisfactory resolution.
Milestone	A principal event specified in the Contract relating to an intermediate completion date or time prior to and including Substantial Completion of all Work.
Modification	A **(1)** written amendment to the Contract signed by both parties, **(2)** Change Order, **(3)** Change Directive, or **(4)** an order for a minor change in the Work.
negotiation	A form of Alternative Dispute Resolution in which all parties involved are represented by those invested with the authority to agree to a determination of an adjustment in the Contract Sum, Contract Times, or both.
Neutral Facilitator	An nonpartisan third-party without decision-making authority who is engaged to assist the Project's key stakeholders in developing cooperative relationships, achieving project objectives, avoiding or minimizing disputes, and nurturing a more-collaborative ethic characterized by trust, cooperation and teamwork.
Notice of Commencement	A notice prepared by the Contracting Authority identifying the Project, the Contractors, the Surety for each Contractor, and the name of the Contracting Authority's representative upon whom a Claim Affidavit may be served.
Notice of Intent to Award	A written notice provided by the Contracting Authority to the apparent successful Bidder stating that upon satisfactory compliance with all conditions precedent for execution of a Contract within the time specified, the Contracting Authority intends to execute a Contract with the Bidder.
Notice to Proceed	A written notice provided by the Contracting Authority authorizing the Contractor to proceed with the Work and establishing the dates for commencement and completion of the Work.
OAC	Ohio Administrative Code
Ohio Facilities Construction Commission	The authorized contracting agent for public improvement projects in accordance with ORC Chapters 123 and 153, acting by and through its Executive Director.
ORC	Ohio Revised Code
Owner	The state of Ohio agency, Institution of Higher Education or division thereof, School District Board, or other instrumentality for whom the Project is being constructed.
Owner's Project Requirements	A written document that details the functional requirements of the Project and the expectations of how it will be used and operated. These include project goals, measureable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
Partial Occupancy	The condition that occurs when the Owner occupies or uses a portion of the Project prior to Contract Completion, partial occupancy is approved by authorities having jurisdiction, and items of Work cannot be completed until a subsequent date.
partnering	A voluntary dispute prevention process involving team building activities to help define common goals, improve communication, and foster a problem solving attitude among a group of contracting parties that must work together throughout Contract performance to be less adversarial and more cooperative.
Person	An individual, corporation, business trust, estate, partnership, association, or other public or private entity.
Phase	A separation in the Work of the Project by sequence or time intervals, which may include separate contractors for each Phase.
Plan Holder	A prospective Bidder that received a set of Contract Documents prior to the bid opening.

Product Data	Manufacturer's standard illustrations, schedules, diagrams, performance charts, instructions, and brochures that illustrate physical appearance, size, and other characteristics of materials and equipment.
Project	The public improvement, of which the Work performed under the Contract Documents may be the whole or a part.
Project Manager	A permanent employee of the Contracting Authority assigned to the Project and authorized to perform specific responsibilities.
Project Manual	That part of Construction Documents which consists of bound volume(s) of primarily written material which generally contain Division 00 - "Procurement and Contracting Requirements," and Divisions 01 through 49 - "Specifications," and other documents pertaining to the Project.
Proposal	The offer of a Contractor to perform the Work set forth in a Proposal Request.
Proposal Request	A document issued after execution of the Contract requesting a Proposal from the Contractor(s), which may initiate a Change Order to modify the Contract.
provide	Furnish and install, complete and ready for intended use.
Punch List	A document listing items of Work requiring correction or completion by the Contractor as a condition precedent to Contract Completion.
Record Documents	Electronic files and printed documents of all nature prepared by the A/E, which incorporate the information shown on the Contractor's As-Built Documents. They consist of the "Record Drawings" and "Record Project Manual," Certificate of Substantial Completion, Certificate of Contract Completion (as complete), Contractor's Warranty, Manufacturers' Warrantees, certificate(s) of occupancy, approved shop drawings and other action submittals, Change Directives, Proposal Requests, Requests for Interpretation, Addenda, Change Orders, Balancing Reports, and the final version of the approved Construction Progress Schedule.
Record Drawings	The Drawings, which have been revised by the A/E to show the changes made during the construction process, conformed to represent the Work as executed by the Contractor.
Record Model	The Building Information Model, which has been revised by the A/E to show the changes made during the construction process, conformed to represent the Work as executed by the Contractor.
Record Project Manual	The Project Manual of the Contract Documents, which has been revised by the A/E to show the changes made during the construction process, based on the As-Built Project Manual furnished by the Contractor.
Request for Change Order	A written notice from the Contractor accompanied by a Proposal for a change in the Work.
Request for Interpretation	A written request to the A/E seeking an interpretation or clarification of the Contract Documents.
RFI	See "Request for Interpretation."
Samples	Physical examples, color selection items, field samples, and mock-ups furnished by the Contractor to illustrate functional and aesthetic characteristics of products, materials, equipment, or workmanship and establish criteria by which the Work shall be judged.
Schedule of Values	A full, accurate, and detailed statement furnished by the Contractor reflecting a defined breakdown of the Contract Sum.
School District	A local, exempted village, or city school district as defined in ORC Chapter 3311, or a joint vocational school established pursuant to ORC Section 3311.18, performing essential governmental functions of state government pursuant to ORC Sections 3318.01 to 3318.20.

School District Board	The board of education of a School District.
Separate Consultant	A Person engaged by the Owner or Contracting Authority to provide Project-related professional services other than the services under this Contract. The term includes the Separate Consultant's authorized representatives, successors, assigns, and subconsultants regardless of tier.
Separate Contract	The contract between the Owner or Contracting Authority and a Separate Consultant or a Separate Contractor.
Separate Contractor	A Person under contract with the Owner or Contracting Authority to provide Project-related work other than the Work under this Contract. The term includes the Separate Contractor's authorized representatives, successors, assigns, and subcontractors regardless of tier.
Shop Drawings	Drawings, diagrams, illustrations, and schedules specifically prepared for the Project provided by the Contractor or a Subcontractor to illustrate some portion of the Work. Shop Drawings are not Contract Documents. Shop Drawings on equipment shall include a written statement from the manufacturer of the equipment certifying the equipment is in compliance with the Contract Documents.
Site	The location designated for the Project.
Specifications	Those portions of the Contract Documents consisting of detailed written administrative, procedural, and technical requirements, included in Divisions 01 through 49, for the construction of the Work, whether physically on the Drawings or bound in separate volumes, including identification of acceptable materials, methods, equipment, quality, and workmanship.
Stage	A distinct period in the life cycle of a facility from concept through construction, to use and deconstruction or demolition. Typical Stages include Program Verification, Schematic Design, Design Development, Construction Documents, Bidding and Award stages; and the Construction Stage, which includes Construction and Closeout activities.
Standard Requirements	The brief name of the "State of Ohio Standard Requirements for Public Facility Construction," including but not limited to General Conditions, and other Division 00 Documents and Division 01 Sections; currently in effect, which the Commission may modify from time to time.
State	The government of Ohio, including any organized body, office, or agency established by the laws of this state for the exercise of any function of state government, any state institution of higher education as defined in ORC Section 3345.011, or any School District Board as defined in ORC Section 3318.01.
Subcontract	Any contract or agreement between the Contractor and a Subcontractor for performance of a portion of the Work.
Subcontract Form	The **State of Ohio Subcontract Form** prescribed by OAC Section 153:1-3-02 and required for use with the General Contracting method of project delivery.
Subcontractor	A Person who undertakes to perform any part of the Work on the Project under a contract with a Contractor or with any Person other than the State, including all such Persons in any tier. The term "Subcontractor" includes Material Suppliers, but does not include any Separate Contractor unless expressly assigned in writing to the Contractor by the Owner and accepted by the Contractor.
Substantial Completion	The stage in the progress of the Work when the Work (or designated portion of the Work for which the Contracting Authority and Owner have agreed to take Partial Occupancy) is sufficiently complete in accordance with the Contract that the Owner can utilize the Work for its intended use, as determined by the A/E. The issuance of a certificate of occupancy or partial certificate of occupancy (if applicable) is a condition precedent to the achievement of Substantial Completion.
Substantially Complete	See "Substantial Completion."

Substitution An article, device, material, equipment, form of construction, or other item, proposed by a prospective Bidder prior to the bid opening and approved by the A/E by Addendum, for incorporation or use in the Work as being functionally and qualitatively equivalent to essential attributes of a Basis of Design or Acceptable Component specified in the proposed Contract Documents.

Supplementary Conditions Amendments to the General Conditions, issued as a separate document, which describe conditions of the Contract unique to a particular Owner or Project, which may include provisions regarding the assignment of responsibility for refuse removal, safety and security precautions and programs, temporary Project facilities and utilities, weather and fire protection, scaffolding and equipment, materials and services to be used commonly by the Contractor and Subcontractors and requiring the Contractor to provide assistance in the utilization of any applicable equipment system, preparation of operation and maintenance manuals, and training of Owner personnel for operation and maintenance of the Project. The General Conditions shall not be superseded or amended by Drawings and Specifications, unless so provided in Supplementary Conditions prepared by the Contracting Authority and approved by the Commission.

Supplementary Instructions Amendments to the Instructions to Bidders, issued as a separate document, which describe instructions unique to a particular Owner or Project. The Instructions to Bidders shall not be superseded or amended by Drawings and Specifications, unless so provided in Supplementary Instructions prepared by the Contracting Authority and approved by the Commission.

Surety A Person providing a Bid Guaranty or a Bond to a Bidder or a Contractor, as applicable, to indemnify the State against all direct and consequential damages suffered by failure of the Bidder to execute the Contract, or of the Contractor to perform the Contract and to pay all lawful claims of Subcontractors, Material Suppliers and laborers, as applicable.

Systems Manual A system focused composite document that includes the operation manual, maintenance manual, and additional information of use to the Owner after they begin using the facility.

Unit Price The cost of providing a unit of Work including labor, materials, services, and associated expenses. Unit Prices do not include the Contractor’s Fee on account of the associated Unit Price Work.

Work The labor, materials, equipment, and services, individually or collectively which are required by the Contract Documents, to be performed or provided by the Contractor for the Project. The furnishing of all material, labor, detailing, layout, supplies, plants, tools, scaffolding, transportation, temporary construction, superintendence, demolition, and all other services, facilities and items reasonably necessary for the full and proper performance and completion of the requirements of the Project as set forth in the Contract Documents, and items reasonably inferable therefrom and consistent therewith for the proper execution and completion of the construction and other services required by the Contract Documents, whether provided or to be provided by the Contractor or a Subcontractor, or any other entity for whom the Contractor is responsible, and whether or not performed or located on or off of the Site.

END OF DOCUMENT

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ARTICLE 1 - CONTRACTOR'S RESPONSIBILITIES

1.1 Nondiscrimination

1.1.1 The Contractor shall comply with Applicable Law regarding equal employment opportunity, including ORC Section 153.59 and all Executive Orders issued by the Governor of the state of Ohio.

1.1.1.1 As required under ORC Section 153.59, the Contractor agrees to both of the following:

.1 "in the hiring of employees for the performance of work under the contract or any subcontract, no contractor, subcontractor, or any person acting on a contractor's or subcontractor's behalf, by reason of race, creed, sex, disability or military status as defined in section 4112.01 of the Revised Code, or color, shall discriminate against any citizen of the state in the employment of labor or workers who is qualified and available to perform the work to which the employment relates; and"

.2 "no contractor, subcontractor, or any person on a contractor's or subcontractor's behalf, in any manner, shall discriminate against or intimidate any employee hired for the performance of work under the contract on account of race, creed, sex, disability or military status as defined in section 4112.01 of the Revised Code, or color."

1.1.1.2 The Contractor shall cooperate fully with the State's Equal Opportunity Coordinator ("EOC"), with any other official or agency of the state or federal government that seeks to eliminate unlawful employment discrimination, and with all other state and federal efforts to assure equal employment practices under the Contract.

1.1.1.3 In the event the Contractor fails to comply with these nondiscrimination clauses, the Contracting Authority shall deduct from the amount payable to the Contractor a forfeiture of the statutory penalty pursuant to ORC 153.60 for each person who is discriminated against or intimidated in violation of this **Section 1.1.1**.

1.1.1.4 The Contract may be terminated or suspended in whole or in part by the Contracting Authority and all money to become due hereunder may be forfeited in the event of a subsequent violation of this **Section 1.1.1**.

1.1.2 Hiring Under State Public Improvement Contracts.

1.1.2.1 Any provision of a hiring hall contract or agreement which obligates the Contractor to hire, if available, only employees referred to the Contractor by a labor organization shall be void as against public policy and unenforceable with respect to employment under any public improvement contract unless at the date of execution of the hiring hall contract or agreement, or within 30 days thereafter, the labor organization has procedures in effect for referring qualified employees for hire without regard to race, color, religion, national origin, military status as defined in ORC Section 4112.01, or ancestry and unless the labor organization includes in its apprentice and

journeyperson's membership, or otherwise has available for job referral without discrimination, qualified employees, both whites and non-whites (including African-Americans).

1.1.3 Affirmative Action.

1.1.3.1 The Contractor and Subcontractors shall comply with the State's Equal Employment Opportunity requirements described under OAC Sections 123:2-3 through 123:2-9 that include, without limitation, the requirements described under this **Section 1.1.3**.

1.1.3.2 The Contractor shall demonstrate its good faith efforts to comply with the utilization goals currently established for minority and women employees and submit documentation to the EOC.

1.1.3.3 By the 10th day of each month, the Contractor and Subcontractors shall submit to the EOC via the internet a completed Ohio Construction Contract Information Report - Input Form 29 (I-29) for the preceding month. The form shall be submitted through the Ohio Business Gateway: http://business.ohio.gov/efiling/.

1.2 Prevailing Wages

1.2.1 The Contractor shall comply with the prevailing wage requirements described under ORC Chapter 4115 that include, without limitation, the requirements described under this **Section 1.2**.

1.2.2 If the Project is subject to payment of prevailing wage rates, the Contractor shall:

1.2.2.1 pay to laborers and mechanics performing Work on the Project the prevailing wage rates of the Project locality, as determined by the Ohio Department of Commerce, Wage and Hour Bureau;

1.2.2.2 post in a prominent place readily accessible by all workers on the Site, a legible listing of the current classifications of laborers, workers, and mechanics employed under this Contract;

1.2.2.3 ensure that the rates posted are current and remain posted in legible condition during the period of the Contract; and

1.2.2.4 not be entitled to an increase in the Contract Sum on account of an increase in prevailing wage rates, except as otherwise provided by Applicable Law.

1.2.3 The Contractor may access the Ohio Department of Commerce, Wage & Hour Bureau at its website, https://wagehour.com.ohio.gov/w3/webwh.nsf/wrlogin/?openform, to obtain the current wage rates.

1.3 Royalties and Patents

1.3.1 The Contractor shall pay all royalties, license fees, and assume all costs incident to the use, in the performance of the Work or the incorporation in the Work, of any invention, design, process, product, or device that is the subject of patent rights or copyrights held by others.

1.3.2 If the Contractor has reason to believe that use of the specified item is subject to patent or copyright protection, the Contractor shall immediately notify the Contracting Authority.

1.4 Assignment of Antitrust Claims

1.4.1 By signing the Agreement, the Contractor assigns, conveys and transfers to the Contracting Authority any right, title, and interest to any claims or causes of action it may have or acquire under state or federal antitrust laws relating to any goods, products, or services purchased, procured, or rendered to the State pursuant to the Contract.

1.5 Use of Domestic Steel

1.5.1 The Contractor is required by law to supply domestically produced steel products used for load bearing structural purposes on all projects funded in whole or in part with State funds.

1.5.2 The Contractor and Subcontractors shall comply with ORC Section 153.011 regarding the use of domestically produced steel products, and furnish the certifications required by **Section 6.20.8**. Copies of ORC Section 153.011 may be obtained from the Ohio Facilities Construction Commission.

1.6 Drug Free Safety Program Participation

1.6.1 Throughout the performance of the Work, the Contractor shall be enrolled in and remain in good standing in the Ohio Bureau of Workers' Compensation ("OBWC") Drug-Free Safety Program ("DFSP") or a comparable program approved by the OBWC that meets the requirements specified in ORC Section 153.03 ("OBWC-approved DFSP").

1.6.2 As required under ORC Section 153.03(E):

1.6.2.1 "Each contractor shall require all subcontractors with whom the contractor is in contract for the public improvement to be enrolled in and be in good standing in the Bureau of Workers' Compensation's Drug-Free Workplace Program or a comparable program approved by the Bureau that meets the requirements specified in section 153.03 of the Revised Code prior to a subcontractor providing labor at the project site of the public improvement."

1.6.2.2 "Each subcontractor shall require all lower-tier subcontractors with whom the subcontractor is in contract for the public improvement to be enrolled in and be in good standing in the Bureau of Workers' Compensation's Drug-Free Workplace Program or a comparable program approved by the Bureau that meets the requirements specified in section 153.03 of the Revised Code prior to a lower-tier subcontractor providing labor at the project site of the public improvement."

1.6.2.3 "Failure of a contractor to require a subcontractor to be enrolled in and be in good standing in the Bureau of Workers' Compensation's Drug-Free Workplace Program or a comparable program approved by the Bureau that meets the requirements specified in section 153.03 of the Revised Code prior to the time that the subcontractor provides labor at the project site will result in the contractor being found in breach of the contract and that breach shall be used in the responsibility analysis of that contractor or the subcontractor who was not enrolled in a program for future contracts with the State for 5 years after the date of the breach."

1.6.2.4 "Failure of a subcontractor to require a lower-tier subcontractor to be enrolled in and be in good standing in the Bureau of Workers' Compensation's Drug-Free Workplace Program or a comparable program approved by the Bureau that meets the requirements specified in section 153.03 of the Revised Code prior to the time that the lower-tier subcontractor provides labor at the project site will result in the subcontractor being found in breach of the contract and that breach shall be used in the responsibility analysis of that subcontractor or the lower-tier subcontractor who was not enrolled in a program for future contracts with the State for 5 years after the date of the breach."

1.6.3 Prior to authorizing a Subcontractor to commence Work on the Site, the Contractor shall obtain the Contracting Authority's approval, and shall also submit written confirmation of the Subcontractor's enrollment on the **Subcontractor and Material Supplier Declaration** form to the A/E.

1.6.4 In addition to OBWC-approved DFSP Basic requirements, the Contractor, each Subcontractor, and each Separate Contractor that provides labor on the Site shall participate in a pool that performs random drug testing of at least 5 percent of its employees who perform labor on the Site. The random drug testing percentage shall also include the on-site supervisors of the Contractor, Subcontractors, and Separate Contractors. Basic random drug testing shall otherwise comply with the same testing guidelines and criteria as required for OBWC-approved advanced testing. The Contractor and Subcontractor shall provide evidence of required testing to the Contracting Authority upon request.

1.7 Use of the State's Web-based Project Management Software

1.7.1 If the Contracting Authority decides, in its sole discretion, to utilize the State's web-based project management software for the Project, the Contractor shall use such software for all compatible services required under this Contract.

1.7.2 All costs for the Contractor's use of the State's web-based project management software for the Project shall be included in the Contract Sum. If the Contractor is unfamiliar with the proper use of such software, the Contractor shall provide its employees for training without additional compensation.

1.8 EDGE Participation and Reporting

1.8.1 The Contractor shall participate in the "Encouraging Diversity, Growth and Equity" ("EDGE") Program by subcontracting with, and using one or more, businesses certified as an EDGE Business Enterprise ("EDGE-certified Business") by the EOC.

1.8.1.1 If the Contractor is an EDGE-certified Business, the Contractor may include its own compensation under this Contract in the reporting.

1.8.1.2 The amount of EDGE participation cannot exceed 100 percent of the Contract Sum.

1.8.1.3 The Contractor shall include in the reporting only those expenditures to EDGE-certified Businesses that perform a commercially useful function as described in OAC Section 123:2-16-15.

1.8.2 The Contractor shall provide an EDGE Participation Report with each Contractor Payment Request.

1.8.2.1 The Contractor shall provide status reports, produced by the Contractor and each applicable EDGE-certified Business for the Contract, indicating:

- **.1** the name of each EDGE-certified Business;
- **.2** the federal tax identification number of each EDGE-certified Business;
- **.3** the date of the EDGE-certified Business contract, Subcontract, or purchase order;
- **.4** the projected and actual start and end dates of the EDGE-certified Business contract, Subcontract, or purchase order;
- **.5** the original amount of the EDGE-certified Business contract, Subcontract, or purchase order with the Contractor;
- **.6** the current amount of the EDGE-certified Business contract, Subcontract, or purchase order;
- **.7** the amount invoiced to date;
- **.8** the amount paid to date;
- **.9** the status of the EDGE-certified Business contract, Subcontract, or purchase order (active, complete, or void); and
- **.10** a statement describing any substantive product or performance deficiencies.

1.8.2.2 The Contractor shall provide reports for each EDGE-certified Business; however, the reports may be consolidated and submitted as one document.

1.8.3 The Contractor shall provide an EDGE Participation Final Report simultaneously with its final Contractor Payment Request.

1.8.3.1 The Contractor and each EDGE-certified Business shall provide in the report certification that the submitted document is a true and accurate accounting of the original contract amount paid to, and received by, each EDGE-certified Business.

1.8.4 The Contractor shall provide the EDGE Participation Reports in detail and form acceptable to the Contracting Authority.

1.8.4.1 Failure to timely submit EDGE Participation Reports may result in withholding payment in accordance with **Section 9.8**.

1.8.5 The Contractor shall cooperate fully with requests for additional EDGE information and documentation from the EOC or Contracting Authority.

1.9 Owner Work Rules

1.9.1 The Contractor shall consult with the Owner to obtain full knowledge of the Owner's rules, regulations, or requirements affecting the Project.

1.10 Emergency

1.10.1 In the event of an emergency affecting the safety of the Project, other property, or individuals, the Contractor, without special instruction or authorization, shall act to prevent the threatened damage, injury, or loss.

1.10.2 If the Contractor believes that it is entitled to an adjustment of the Contract Sum or Contract Times, or both, on account of its actions in response to an emergency, the Contractor may request a Modification by giving written notice under **Section 7.3.2**.

1.11 Contractor's Standard of Care

1.11.1 The Contractor shall perform the Work in a workmanlike manner, consistent with the standards of skill and care exercised by entities licensed to perform (where required under Applicable Law) and regularly performing comparable work in the same or similar locality under the same or similar circumstances.

1.12 Limit of Contractor's Responsibility

1.12.1 The Contractor is not responsible for the A/E's negligence or the A/E's failure to properly perform the A/E's contract.

1.13 Sustainability Requirements

1.13.1 This Project shall be designed and constructed in accordance with the requirements of Am. Sub. H.B. 251 of the 126th General Assembly and the resulting rules, policies, and procedures adopted by the Ohio Facilities Construction

Commission establishing Sustainability Requirements for Capital Improvements Projects, including but not limited to the applicable provisions of OAC 3318-3.

1.13.2 If the Project is designed and constructed under the Leadership in Energy and Environmental Design ("LEED") Rating System developed by the U.S. Green Building Council or another rigorous rating system used to facilitate achievement of sustainability goals for the Project, the Contractor shall provide submittals certifying achievement of sustainable design rating system criteria for verification by the Green Building Certification Institute or other third party in accordance with the Contract Documents.

ARTICLE 2 - STATE'S RIGHTS AND RESPONSIBILITIES

2.1 Contracting Authority

2.1.1 The Contracting Authority shall designate a Project Manager for the Project. The Project Manager is authorized to act on behalf of the Contracting Authority to perform specific responsibilities under the Contract.

2.1.2 The Contracting Authority shall furnish information and services required of it in a timely manner.

2.1.3 The Contracting Authority shall have access to the Work at all times, whenever the Project is in preparation or progress.

2.1.4 The Ohio Facilities Construction Commission requires use of its forms where indicated in the Contract Documents. The party responsible for initiating forms shall utilize the latest edition obtained from the Commission's website: http://ofcc.ohio.gov. The Commission may make modifications to its forms at any time.

2.1.4.1 The Contractor shall not modify any form provided by the Commission or Contracting Authority.

2.1.4.2 If the Project is administered using the State's web-based project management software, the Contractor shall utilize the web-based forms and reports within the applicable business process. The State's web-based project management software is sponsored by the Commission, and such web-based forms and reports are acceptable to the Commission in lieu of its paper forms.

2.1.5 The Contracting Authority is not responsible for construction means, methods, manners, techniques, sequences, procedures, or for safety precautions and programs in connection with the Work, or for the Contractor's failure to carry out the Work in conformity with the Contract Documents.

2.2 Owner

2.2.1 The Owner shall designate a representative authorized to act on behalf of the Owner during the Project.

2.2.2 The Owner shall furnish information and services required of it in a timely manner.

2.2.3 The Owner shall have access to the Work at all times whenever the Project is in preparation or progress.

2.2.4 Upon issuance of the Notice to Proceed, the Owner shall provide the Site to the Contractor in a condition to permit the Contractor to perform the Work.

2.2.5 The Owner may request a change in the Work if the A/E recommends and the Contracting Authority approves the change.

2.2.6 The Owner shall communicate with the Contractor through the Contracting Authority.

2.2.7 The Owner is not responsible for construction means, methods, manners, techniques, sequences, procedures, or for safety precautions and programs in connection with the Work, or for the Contractor's failure to carry out the Work in conformity with the Contract Documents.

2.3 Approval of Owner, Contracting Authority, and State

2.3.1 The Owner, Contracting Authority, or State's review and approval of the Work and any information the Contractor submits to them is for the sole purpose of determining whether the Work and information are generally consistent with the Contract's intent, and will not relieve the Contractor of its sole responsibility for the performance, preparation, completeness, and accuracy of the Work and information.

2.4 Neutral Facilitation

2.4.1 The Contracting Authority or Owner may engage a Neutral Facilitator for the purposes of **(1)** building cooperative relationships among the Project participants to achieve discrete objectives; **(2)** encouraging educated, productive, and

expedited attempts to avoid, minimize, and resolve disputes; and **(3)** maximizing the effectiveness of each participant's resources.

2.4.1.1 For example, a Neutral Facilitator may facilitate the organizational meeting, partnering session(s), and efforts to resolve disputes throughout the Project.

2.4.2 The Contracting Authority, Owner, and Contractor are entitled to interact with the Neutral Facilitator with the full expectation that **(1)** they may act, speak, and disclose information with complete candor and **(2)** all communication, whether oral or written, made in the course of facilitated sessions is confidential.

2.4.3 At any hearing or proceeding regarding any dispute arising out of or related to the Project **(1)** the Neutral Facilitator will not be competent to testify and shall not be called as a witness and **(2)** the Neutral Facilitator's testimony and work product will not be admissible.

2.4.4 The Neutral Facilitator will not **(1)** perform any services with respect to or bear any responsibility for any legal services, design-professional services, construction, or construction management associated with the Project or **(2)** have any liability whatsoever for any claims related to any legal services, design-professional services, construction, or construction management associated with the Project, including without limitation, claims for legal or design-professional errors or omissions, delays, cost overruns, faulty construction, or increased costs.

2.4.5 The Neutral Facilitator's participation in the Project will not relieve the Contracting Authority, Owner, and Contractor of any of their respective rights or obligations under the Contract.

2.5 Contractor Performance Evaluation

2.5.1 The Contracting Authority may evaluate the Contractor's performance during the progress of the Work, at completion of a phase of the Project, completion of the Project, or any of the foregoing. The Contracting Authority shall retain the evaluation(s).

2.5.1.1 The Contractor may request a copy of the completed evaluation(s). If the Contractor wishes to comment or take exception to any rating or remark, the Contractor must send a response in writing to the Contracting Authority within 30 days of receiving the evaluation(s).

2.5.1.2 The Contracting Authority may use the evaluation(s) in determining the responsibility of the Contractor for award of future contracts.

2.5.1.3 The Contracting Authority may request information from the Contractor for use in evaluating the A/E's performance. If information is requested, the Contractor must comply in a timely and responsive manner.

2.5.1.4 If a breach of the Contract is committed by the Contractor or is attributable to a Subcontractor, that breach will be used in the responsibility analysis of the Contractor and Subcontractor (where applicable) for future contracts with the State or subcontracts on State projects for 5 years after the date of the breach.

ARTICLE 3 - A/E'S RESPONSIBILITIES

3.1 The A/E's Contract Administration Duties

3.1.1 The A/E shall administer the Contract as provided in the Contract Documents and Architect/Engineer Agreement, including, but not limited to, performance of the functions described as follows:

3.1.1.1 The A/E shall attend and conduct progress meetings. The A/E shall prepare an agenda and produce a written report of each progress meeting, and distribute the report to the Contracting Authority, Owner, and Contractor within 3 business days after the meeting. The A/E shall not delegate the duty to prepare the agenda and written reports of any progress meeting.

3.1.1.2 The A/E may authorize minor changes or alterations in the Work that are consistent with the intent of the Contract Documents and do not involve adjustment of the Contract Sum or Contract Times, or both. The A/E has no authority to authorize the Contractor to perform additional or extra Work for which the Contractor may seek adjustment of the Contract Sum or Contract Times, or both.

3.1.1.3 The A/E shall review and recommend, certify, or approve applicable forms required under the Contract Documents.

3.1.1.4 The A/E shall render decisions in connection with the Contractor's responsibilities under the Contract Documents, and submit recommendations to the Contracting Authority for enforcement of the Contract as necessary.

3.1.2 The A/E is the initial interpreter of all requirements of the Contract Documents. All decisions of the A/E are subject to final determination by the Contracting Authority.

3.2 Site Visits and Observation

3.2.1 The A/E shall notify, advise, and consult with the Contracting Authority and Owner and protect the State against Defective Work throughout completion of the Project, which includes the Correction Period.

3.2.1.1 The A/E shall designate a field representative, subject to the Contracting Authority's approval, to attend to the Project, to observe and check the progress and quality of the Work, and to take action as necessary or appropriate to achieve conformity with the Contract Documents.

3.2.1.2 The A/E shall have its consultants attend to the Project at intervals required by its agreement or the Contracting Authority.

3.2.2 The A/E is authorized to disapprove or reject Defective Work. The A/E shall immediately notify the Contracting Authority any time the A/E disapproves or rejects an item of Work.

3.2.3 The A/E is not responsible for construction means, methods, manners, techniques, sequences, procedures, or for safety precautions and programs in connection with the Work, or for the Contractor's failure to carry out the Work in conformity with the Contract Documents.

3.3 Testing and Inspection Services

3.3.1 Unless otherwise specified in the Contract Documents, the A/E shall apply for, secure, and pay for the costs of structural testing and special inspections under Chapter 17 of the Ohio Building Code; testing including geotechnical analysis, environmental testing and analysis, concrete, masonry, structural steel, reinforcing steel, welding, bolts, steel connections, HVAC systems and controls, plumbing and piping, air and water balancing and testing, or other testing; or approval required by Applicable Law.

3.4 Approval of A/E

3.4.1 The A/E's review and approval of the Work and any information the Contractor submits to the A/E is for the sole purpose of determining whether the Work and information are generally consistent with the Contract's intent, and will not relieve the Contractor of its sole responsibility for the performance, preparation, completeness, and accuracy of the Work and information.

3.5 Limitation of A/E's Authority

3.5.1 Under no circumstances is the A/E authorized to:

3.5.1.1 bind the Owner or Contracting Authority to any authorizations under, modifications of, or amendments to any contract other than as expressly described under **Section 3.1.1.2**;

3.5.1.2 accept any defective or non-conforming services, Work, or vendor-furnished items;

3.5.1.3 make any settlements on behalf of the Owner or Contracting Authority; or

3.5.1.4 assume any responsibilities of the Contractor or Subcontractors.

ARTICLE 4 - SUBCONTRACTORS

4.1 Evaluation and Approval

4.1.1 Within 10 days after the Notice to Proceed, or other period as mutually agreed by the Contractor and Contracting Authority, the Contractor shall submit to the A/E a **Subcontractor and Material Supplier Declaration** form through which the Contractor identifies its Subcontractors.

4.1.2 The Contractor's failure to timely submit the information regarding a proposed Subcontractor may result in withholding payment in accordance with **Section 9.8**.

4.1.3 After receiving the **Subcontractor and Material Supplier Declaration** form, the A/E shall verify that it is complete and deliver it to the Contracting Authority and Owner. If the A/E finds the form incomplete, the A/E shall return it to the Contractor and identify the incomplete information.

4.1.4 If the Contracting Authority rejects any proposed Subcontractor, the Contractor shall propose a replacement Subcontractor with no adjustment of the Contract Sum. The proposed replacement Subcontractor will be evaluated as described above.

4.1.5 No less than 10 days before Work is to be performed by the Subcontractor, or within a shorter period as mutually agreed by the Contractor and Contracting Authority, the Contractor shall submit to the Contracting Authority a complete copy of the executed Subcontract between the Contractor and Subcontractor.

4.2 Form of Subcontract

4.2.1 All Subcontracts shall be on the **State of Ohio Subcontract Form** prescribed by OAC Section 153:1-03-02.

4.2.2 No less than 10 days before Work is to be performed by a Subcontractor, or within a shorter period as mutually agreed by the Contractor and Contracting Authority, the Contractor shall submit to the Contracting Authority and A/E a complete copy of the executed Subcontract between the Contractor and Subcontractor. After receiving the Subcontract, the A/E shall verify that it is complete and deliver it to the Contracting Authority. If the A/E finds the Subcontract incomplete, the A/E shall return it to the Contractor and identify the incomplete information.

4.3 Replacement of Subcontractors

4.3.1 The Contractor shall not replace any Subcontractor after execution of the Subcontract without the prior written approval of the Contracting Authority.

4.4 Contractor's Responsibility

4.4.1 The Contractor is fully responsible for all acts and omissions of its Subcontractors and is responsible for scheduling and coordinating the Work of its Subcontractors.

4.4.1.1 The Contractor is fully responsible for any delay, interference, disruption, or hindrance attributable to the Contractor's Subcontractors.

4.4.1.2 The Contractor shall require that each of its Subcontractors have a competent supervisor at the Site whenever the Subcontractor is performing Work.

4.4.1.3 The Contractor shall bind its Subcontractors to the terms of the Contract Documents, so far as applicable to the Work of the Subcontractor, and shall not agree to any provision, which seeks to bind the State to terms inconsistent with or at variance from the Contract Documents.

4.4.2 The Contractor will not be relieved of its full responsibility for Subcontractors and their performance of the Work by **(1)** the participation of the Owner, Contracting Authority, and A/E in the processes described under this **Article 4** or other related provisions of the Contract Documents or **(2)** the Contracting Authority's rejection of a Subcontractor or failure to reject a Subcontractor under **Section 4.1**.

4.5 Contingent Assignment of Subcontracts

4.5.1 The Contractor hereby assigns its agreement with each Subcontractor to the Contracting Authority provided that the assignment is effective only after termination of the Contract by the Contracting Authority and only for those agreements that the Contracting Authority accepts by notifying the Contractor and applicable Subcontractor in writing. The Contracting Authority may re-assign accepted agreements.

4.6 Prompt Payment

4.6.1 The Contractor shall make payments to Subcontractors in accordance with Applicable Law, including ORC Section 4113.61 that include, without limitation, the requirements described under this **Section 4.6**.

4.6.1.1 If a Subcontractor requests payment in time to allow the Contractor to include the request in its Contractor Payment Request, the Contractor shall pay within 10 days after receipt of payment from the State:

- **.1** To a Subcontractor other than a Material Supplier, an amount equal to the percent of completion allowed by the Contracting Authority for the Subcontractor's Work.
- **.2** To a Material Supplier, an amount equal to all or that portion of the Contractor Payment Request that represents the materials furnished by the Material Supplier.

4.6.2 The Contractor may reduce the amount paid to a Subcontractor pursuant to **Section 4.6.1** at a rate equal to the percentage retained from the Contractor and may withhold amounts necessary to **(1)** resolve disputed liens or claims involving the Work of the Subcontractor or **(2)** account for the failure of the Subcontractor to perform its obligations under its agreement with the Contractor.

4.6.2.1 Labor Payments.

.1 Partial payments to the Subcontractor for labor performed under either a Unit Price or lump sum Subcontract shall be made at the rate of 92 percent of the amount invoiced through the Subcontractor's request for payment that shows the Work of the Subcontractor is 50 percent complete.

.2 After the Work of the Subcontractor is 50 percent complete, as evidenced by payments of at least 50 percent of the total amount due under the Subcontract, no additional funds shall be retained from payments for labor.

4.6.2.2 Material Payments.

.1 The Contractor shall pay the Subcontractor at the rate of 100 percent of the scheduled value for materials incorporated into the Project.

.2 The Contractor shall pay the Subcontractor at the rate of 92 percent of the invoice cost, not to exceed the scheduled value in a Unit Price or lump sum Subcontract, for materials delivered to the Site, or other off-site storage location approved by the A/E, provided the Subcontractor provides the information required by **Sections 9.6.2.1** and **9.6.2.2** with its request for payment.

4.6.3 If the Contractor fails to comply with this **Section 4.6**, the Contractor shall pay to the applicable Subcontractor 18 percent interest, compounded annually, on any unpaid amount beginning on the 11th day after receipt of payment from the State.

4.6.4 In order to establish lien rights, Subcontractors shall comply with Applicable Law, including ORC Sections 1311.26, 1311.261, and 1311.29.

4.6.5 If the Contracting Authority receives a Claim Affidavit from a Subcontractor, it shall proceed as required by Applicable Law, including ORC Sections 153.63 and 1311.31.

4.6.6 Laborers, Subcontractors, and Material Suppliers may secure payment rights in accordance with Applicable Law, including ORC Section 153.56.

ARTICLE 5 - PRECONSTRUCTION ACTIVITIES

5.1 Partnering

5.1.1 The formation of a cohesive, mutually beneficial partnering arrangement among the Contractor, Contracting Authority, A/E, and Owner will accomplish the construction of the Project most effectively and efficiently. This arrangement draws on their collective strengths, skills, and knowledge to achieve a Project of the intended quality, within budget, and on schedule. To achieve that objective, participation in a partnering session is required for the following key stakeholders:

5.1.1.1 Contracting Authority: Project Manager

5.1.1.2 Owner: Primary representative

5.1.1.3 A/E: Principal-in-charge, project manager, field representative, major consultants

5.1.1.4 Contractor: Principal-in-charge, project manager, and superintendent

5.1.1.5 Major Subcontractors (e.g., plumbing, HVAC, electrical): Principal-in-charge, project manager or superintendent

5.1.1.6 CxA, if applicable

5.1.2 The purpose of the partnering arrangement is to build cooperative relationships between the Project's key stakeholders, avoid or minimize disputes, and nurture a more collaborative ethic characterized by trust, cooperation and teamwork. This arrangement is intended to produce a voluntary, non-binding, but formally structured agreement among the Project's key stakeholders, leading to an attitude that fosters risk sharing.

5.1.3 To create and implement the partnering arrangement, the Project's key stakeholders shall meet prior to the construction of the Project for developing a partnering agreement. The agreement should be comprehensive and focus on all issues necessary for successful completion of the Project, and shall identify common goals and objectives, develop a problem solution process, an Alternative Dispute Resolution ("ADR") strategy in accordance with **Section 8.13**, and an implementation plan for the partnering arrangement.

5.1.4 Formal contractual relations, responsibilities, and liabilities are not affected by any partnering arrangement. The cost associated with establishing this partnership, including but not limited to engaging the services of a Neutral

Facilitator, shall be included in an allowance in the Contractor's bid. The Contractor shall include in its base bid the resources necessary to participate in the partnering session.

5.1.5 Partnering services may extend over the entire period of performance of the Contract and may include intervention or project realignment services to be utilized if serious disputes arise. The Project's key stakeholders should agree, during the initial partnering session, to the types of situations and circumstances in which intervention or realignment services shall be utilized.

5.2 Building and Trade Permits and Licenses

5.2.1 Plan Approval.

5.2.1.1 The A/E shall secure the required structural, plumbing, HVAC, and electrical plan approvals.

5.2.1.2 The Contractor shall schedule and attend all intermediate and final inspections required for any permit applicable to the Work. The Contractor shall schedule the State Fire Marshal or local fire authority for the life safety inspection for occupancy permits. The Contractor shall give the A/E, Contracting Authority, and Owner reasonable notice of the dates and times arranged for inspections.

.1 The Contractor shall pay for any reinspections required as a result of the Contractor's failure to receive approval of its Work.

5.2.2 Trade Permits and Licenses.

5.2.2.1 The Contractor shall obtain, maintain, and pay for any permit, inspection, or license applicable to the Contractor's particular trade.

5.2.3 Local Permits.

5.2.3.1 The Contractor shall secure and pay the fees for any permits, inspections, licenses, capacity charges, or tap fees required by local authorities having jurisdiction over the Project. The Contractor shall give the A/E, Contracting Authority, and Owner reasonable notice of the date arranged for inspections.

5.2.4 National Pollutant Discharge Elimination System ("NPDES") Storm Water General Permit.

5.2.4.1 The A/E shall secure the NPDES general permit by submitting a Notice of Intent ("NOI") application form to the Ohio Environmental Protection Agency at least 45 days prior to the start of construction. The Contractor shall be a "co-permitee" if required under Applicable Law.

5.2.4.2 The A/E shall prepare and certify a storm water pollution prevention plan to provide sedimentation and erosion controls at the Project.

5.2.4.3 The A/E shall prepare and process the required Notice of Termination ("NOT") prior to Contract Completion.

ARTICLE 6 - CONSTRUCTION AND CLOSEOUT

6.1 Commencement of Work on the Site

6.1.1 Unless the Contracting Authority agrees otherwise in writing, the Construction Stage will commence with the Contracting Authority's issuance of the Notice to Proceed and will terminate upon Contract Completion.

6.2 Responsibility of the Contractor

6.2.1 The Contractor shall complete portions of the Work in the sequence and time in the Construction Progress Schedule.

6.2.2 The Contractor shall supervise the Work.

6.2.3 The Contractor must perform the Work so as not to interfere with, disturb, hinder, or delay the services of Separate Consultants or the work of Separate Contractors. The Contractor must cooperate and coordinate fully with all Separate Consultants and Separate Contractors and must freely share all of the Contractor's Project-related information with them to facilitate the timely and proper performance of the Work and of the services and work of the Separate Consultants and Separate Contractors.

6.2.4 The Contractor must afford every Separate Consultant and Separate Contractor proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of their services and work.

6.2.5 If the Contractor damages the property or work of any Separate Consultant or Separate Contractor, or by failure to perform the Work with due diligence, delays, interferes with, hinders, or disrupts the services of any Separate Consultant or the work of any Separate Contractor who suffers additional expense and damage as a result, the Contractor is responsible for that damage, injury, or expense.

6.2.6 The intent of **Sections 6.2.3** through **6.2.5** is to benefit the Separate Consultants and Separate Contractors, and to demonstrate that the Separate Consultants and Separate Contractors are intended third-party beneficiaries of the Contractor's obligations under the Contract.

6.2.7 If the proper execution or results of any part of the Work depends upon work performed or services provided by the Owner, a Separate Consultant, or a Separate Contractor, the Contractor must inspect that other work and appropriate instruments of service, and promptly report to the Contracting Authority in writing any defects or deficiencies in that other work or services that render it unavailable or unsuitable for the proper execution and results of the Work. The Contractor's failure so to report will constitute an acceptance of the other work and services as fit and proper for integration with the Contractor's Work except for defects and deficiencies in the other work or services that were not reasonably discoverable at the time of the Contractor's inspection.

6.2.8 The Contractor shall not delay the Work on account of any claim, dispute, or action between the Contractor and a Separate Consultant or Separate Contractor.

6.2.9 The Contractor shall develop and keep current the Construction Progress Schedule in accordance with **Section 6.5**, and prepare and keep current a schedule of submittals that is coordinated with the Construction Progress Schedule, for the A/E and Contracting Authority's acceptance.

6.2.10 The Construction Progress Schedule shall not exceed the time limits current under the Contract Documents, shall provide for reasonable, efficient, and economical execution of the Project, and shall relate to the entire Project to the extent required by the Contract Documents.

6.2.11 The Contractor shall use the Construction Progress Schedule to plan, organize, and execute the Project, record and report actual performance and progress, and show how it plans to coordinate and complete all remaining work by Contract Completion.

6.2.12 The Contractor shall monitor the progress of the Work for conformance with the Construction Progress Schedule and shall initiate revisions as required by **Section 6.5.14**.

6.2.13 The Contractor shall establish the Project's regular working hours, subject to approval by the A/E and the Owner.

6.2.14 The Contractor shall coordinate the Work with the activities and responsibilities of the A/E, Owner, and Contracting Authority to complete the Project in accordance with the Contract Documents.

6.2.15 In the event of default of the Contractor, the Contractor shall cooperate with the A/E, Contracting Authority, and Contractor's Surety to achieve the Substantial Completion date and Contract Completion.

6.2.16 The Contractor shall remove all snow and ice as may be required for reasonably safe access to the Project including, but not limited to, building entries, driveways, parking lots, and sidewalks.

6.2.17 The Contractor shall keep a daily log containing a record of weather, number of workers on Site for the Contractor, identification of equipment, Work accomplished, problems encountered, and other similar relevant data.

6.3 Construction Procedures

6.3.1 The Contractor is solely responsible for and has control over all construction means, methods, manners, techniques, sequences, and procedures, for safety precautions and programs in connection with the Work, and for coordinating all portions of the Work.

6.3.1.1 If the Contract Documents give instructions that affect construction means, methods, manners, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety of them and, except as stated below, shall be fully and solely responsible for the jobsite safety of the means, methods, manners, techniques, sequences, or procedures.

6.3.1.2 If the Contractor determines that the means, methods, manners, techniques, sequences, or procedures specified in the Contract Documents may not be safe, the Contractor shall give timely written notice to the A/E, Owner, and Contracting Authority. The Contractor shall not proceed with that portion of the Work without further written instructions from the A/E. Any modification of the Contract shall be in accordance with **Article 7**.

6.3.2 The Contractor shall lay out and coordinate all lines, levels, elevations, and measurements for all of the Work, coordinate and verify existing conditions, and notify the A/E of discrepancies and conflicts before proceeding with installation or excavation.

6.3.3 The Contractor shall perform all cutting, fitting, or patching required for the Work and shall not endanger the Project by cutting, excavating, or otherwise altering the Project, or any part of it.

6.3.3.1 If the Contractor requires sleeves for the Work, the Contractor shall furnish and install the sleeves. The Contractor is responsible for the exact location and size of all holes and openings required to be formed or built for the Work.

6.3.3.2 The Contractor's patching shall match and blend with the existing or adjacent surface(s).

6.3.4 The Contractor shall comply with ORC Sections 3781.25 through 3781.32. In addition, before starting excavation or trenching, the Contractor shall determine the location of any underground utilities and notify any public authority or utility having jurisdiction over the Project and secure any required approval.

6.3.4.1 The Contractor shall give notice at least 2 business days in advance of excavation to the owners of underground utilities registered with the Ohio Underground Utility Protection Services ("OUPS" at http://oups.org, phone 811 or 800-362-2764), and the owners of underground utilities shown on the Drawings and Specifications who are not registered members of OUPS. The owner of an underground utility is required within 48-hours' notice to stake, mark, or otherwise designate the location of its utilities in the construction area together with its approximate depth. In the event that any underground utility owner fails to timely perform, the Contractor shall notify the A/E and contact the owner of the underground utility.

6.3.5 The Contractor shall install all Work in accordance with the Contract Documents and any installation recommendations of the manufacturer, including required temperature and humidity limits for installation of the various materials.

6.3.6 The Contractor shall comply with all requirements and conditions of the NPDES general permit, including, but not limited to, implementing and maintaining the sedimentation and erosion control measures specified in the storm water pollution prevention plan prepared by the A/E pursuant to **Section 5.2.4**, which are related to the Work, maintaining records of its construction activities, removing materials no longer required, and taking proper action if there is a reportable quantity spill.

6.3.7 The Contractor shall communicate with the Contracting Authority and Owner through the A/E.

6.4 Construction Supervision

6.4.1 Unless waived by the Contracting Authority in writing, the Contractor shall provide continuous supervision at the Site by a competent superintendent when any Work is being performed and the Contractor's superintendent shall not be involved with any work other than the Project.

6.4.2 The Contractor's project manager and superintendent shall each have the responsibility and authority to act on behalf of the Contractor. All communications to the Contractor's project manager or superintendent shall be binding as if given directly to the Contractor.

6.4.3 The Contractor shall submit an outline of the qualifications and experience of the Contractor's proposed project manager and proposed superintendent, including references, to the Contracting Authority no less than 10 days of the Notice to Proceed. For all Subcontracts in excess of $200,000, and for all other Subcontracts on request from the Contracting Authority, the Contractor shall submit an outline of the qualifications and experience of the Subcontractor's proposed project manager and proposed superintendent, including references, to the Contracting Authority no less than 10 days before the Subcontractor is scheduled to begin Work on the Site.

6.4.3.1 The Contracting Authority may reject the Contractor or Subcontractor's proposed project manager or proposed superintendent. If the Contracting Authority does not notify the Contractor of the rejection within 30 days after receiving the required information, it shall indicate that the Contracting Authority has no objection, but does not affect the Contracting Authority's rights under **Section 6.12.2** or any other provision relative to that project manager or superintendent.

6.4.3.2 If the Contracting Authority rejects the Contractor or Subcontractor's proposed project manager or proposed superintendent, the Contractor shall replace, or cause the Subcontractor to replace the project manager or superintendent (as appropriate) with someone acceptable to the Contracting Authority at no additional cost.

6.4.4 The Contractor and its Subcontractors subject to **Section 6.4.3** shall not replace their respective project managers or superintendents without prior written approval of the Contracting Authority.

6.4.4.1 If the Contractor or a Subcontractor subject to **Section 6.4.3** proposes to change its project manager or superintendent, the Contractor shall submit written justification to the Contracting Authority, along with the name and qualifications of the proposed replacement.

6.4.4.2 The procedure provided in **Section 6.4.3** shall be conducted to evaluate the Contractor or Subcontractor's (as applicable) proposed replacement project manager or superintendent.

6.5 Construction Progress Schedule

6.5.1 If the Estimated Construction Cost is less than $500,000, the Contractor may provide a bar chart schedule with a logical sequence of events and sufficient detail to properly anticipate and monitor construction progress. If the Estimated Construction Cost for the Project is $500,000 or more, the Contractor shall prepare and maintain a resource-loaded Construction Progress Schedule using the critical-path method of scheduling that provides the following information:

6.5.1.1 a graphic presentation of the sequence of the Work for the Project in the media and format required for the Project;

6.5.1.2 identification of each stage of the Work and any Milestone dates;

6.5.1.3 identification of activities and durations for review and approval of Shop Drawings and other action submittals, fabrication and review of mock-up Work, product review and procurement, fabrication, shop inspection, and delivery, including, but not limited to, lead time, coordination drawing delivery, Substantial Completion, Punch List, Punch List Correction, Project close-out requirements, occupancy requirements, and Contract Completion;

6.5.1.4 identification of disruptions and shutdowns due to other operations;

6.5.1.5 identification of the critical path of the Work;

6.5.1.6 identification of the crew size and total resource hours for each activity in the schedule; and

6.5.1.7 the Contractor's signature and date indicating approval.

6.5.2 The Contractor shall develop the Construction Progress Schedule using commercially available, personal computer software acceptable to the Contracting Authority and shall submit all baseline and updated schedules to the A/E in the schedules' native electronic format.

6.5.3 The Construction Progress Schedule shall not exceed the time limits current under the Contract Documents, shall provide for reasonable, efficient, and economical execution of the Project, and shall relate to the entire Project to the extent required by the Contract Documents.

6.5.4 The Contractor shall use the Construction Progress Schedule to plan, organize, and execute the Project, record and report actual performance and progress, and show how it plans to coordinate and complete all remaining Work within applicable Milestones. The Project participants shall use the Construction Progress Schedule as a tool for scheduling and reporting sequenced progress of the Work. The Contractor shall provide a clear graphics legend and other data including, but not limited to, Milestone dates, constraints, and other items required by the Project, A/E, Contracting Authority, and Owner. Each submission shall show the Contracting Authority's Project number and Project name, and provide a signature approval and date line for the Contractor.

6.5.5 The Contractor shall provide in each schedule: Activity identification and description for each activity broken down to a maximum duration that is appropriate for the activity, responsibility of the Contractor, Contractor's resources and crew size for each activity, provide early start, early finish, late start, late finish dates. Each schedule shall show predecessor activities and successor activities for each activity, entry free float, total float, and percentage of completion, and identify the appropriate predecessors and successors for all related activities.

6.5.6 The Construction Progress Schedule shall show all submittal dates, review and approval durations for coordination drawings, Shop Drawings, other action submittals, and mock-up Work.

6.5.7 Within 30 days of the date of the Notice to Proceed, the Contractor shall submit to the A/E a proposed Construction Progress Schedule approved by the Contractor. If the Project is $4 million total construction cost or more, the Contractor may submit an intermediate Bar Chart Schedule for the first 120 days to the A/E within 30 days of the date of the Notice to Proceed; followed by the complete resource-loaded precedence or arrow diagram schedule within 90 days of the date of the Notice to Proceed.

6.5.7.1 The Contractor shall submit the initial and all updates of the Construction Progress Schedule in graphic and tabular form to the A/E. With each monthly schedule update, the Contractor shall include a list of all changes to the previously approved baseline schedule or monthly updated schedule.

6.5.7.2 After receiving the Construction Progress Schedule, the A/E shall review and submit a copy of the Construction Progress Schedule to the Contracting Authority and Owner for review and acceptance, or reject and return it to the Contractor with recommendations for revisions.

6.5.8 The Construction Progress Schedule shall be managed using early start dates and early finish dates. The Contractor must exhaust existing float before claiming additional time for a Change Order, or show that it is not possible to use float to cover the time requirements of the Change Order.

6.5.9 The Contractor's failure to timely submit and properly maintain an approved Construction Progress Schedule may result in withholding payment in accordance with **Section 9.8**.

6.5.10 For each progress meeting, the Contractor shall provide a 2- to 6-week look-ahead schedule, as appropriate for the Project.

6.5.11 On a weekly basis, the Contractor shall prepare and submit to the A/E a written report describing:

6.5.11.1 activities begun or finished during the preceding week;

6.5.11.2 activities in progress and expected completion;

6.5.11.3 activities to be started or finished in the upcoming 2 weeks, including but not limited to, the Contractor's workforce size and total resource hours associated with those activities; and

6.5.11.4 other information requested by the A/E.

6.5.12 The A/E shall attach the above information to the minutes of the weekly progress meetings.

6.5.13 The Contractor shall provide monthly Progress Status Reports to the Contracting Authority, A/E, and Owner, which shall include recommendations for adjusting the Construction Progress Schedule to meet Milestone dates and the Substantial Completion date.

6.5.13.1 If it is apparent to the A/E that the Contractor may be unable to meet critical path activities, Milestone completion dates, or the Substantial Completion date, the A/E shall direct the Contractor to submit within 3 days a recovery plan to avoid or minimize delay to the Project.

6.5.13.2 A recovery plan shall include, but is not limited to, adjustments to one or more of the following:

- **.1** workforce
- **.2** hours per shift
- **.3** shifts per workday
- **.4** workdays per week
- **.5** equipment
- **.6** activity logic

6.5.13.3 If the A/E approves the recovery plan, the Contractor shall prepare a revised Construction Progress Schedule approved in accordance with **Section 6.5.7**. If the A/E does not approve the recovery plan, the Contractor shall submit within 3 days an alternate recovery plan to the A/E in writing for review and approval in accordance with **Section 6.5.7**.

6.5.14 The Contractor shall update the Construction Progress Schedule on a monthly basis, or other interval approved by the Contracting Authority, in accordance with **Section 6.5.7**.

6.5.14.1 The updated Construction Progress Schedule approved by the Contractor shall serve as an affirmation that the Contractor can meet the requirements of the updated Construction Progress Schedule.

6.5.14.2 The Contractor shall submit a tabular copy showing all changes to the previously approved schedule including, but not limited to, logic, float, and actual start date of activities. The original or initially approved Construction Progress Schedule and all subsequent Construction Progress Schedules submitted by the Contractor, and accepted by the A/E, shall serve as an affirmation that the Contractor agrees to and can meet the applicable requirements of the updated Construction Progress Schedule.

6.5.15 The Contractor's failure to timely submit an approved, updated Construction Progress Schedule may result in withholding payment in accordance with **Section 9.8**.

6.6 Progress Meetings

6.6.1 The A/E shall schedule a weekly progress meeting for the Contractor and other Persons involved in the Project. The purpose of the progress meeting is to review progress on the Project during the previous week, discuss anticipated progress during the following weeks, review critical operations, and discuss critical problems.

6.6.2 The Contractor shall be represented at every progress meeting by a Person authorized with signature authority to make decisions regarding possible modification of the Contract Documents or Construction Progress Schedule.

6.6.2.1 The A/E shall notify the Contractor and other Persons involved in the Project of the time and place of the progress meeting that shall thereafter be the same day and hour of the week for the duration of the Project, unless the A/E notifies the Contractor and other Persons involved in the Project of a different day and hour at least 2 days in advance.

6.6.2.2 The Contractor shall have any of its Subcontractors attend the progress meeting as determined advisable by the Contractor, or as requested by the A/E.

6.6.3 The A/E shall prepare a written report of each progress meeting and distribute the report to the Contracting Authority, Owner, and Contractor. The A/E shall not delegate the duty to prepare a written report of any progress meeting.

6.6.3.1 If any Person in attendance objects to anything in a report of a progress meeting, the Person shall notify the A/E, Contracting Authority, and any other affected Person in writing explaining the objection within 5 days.

6.6.3.2 The report of each progress meeting shall reflect any objection made to the report of the previous progress meeting and any response.

6.7 Project Coordination

6.7.1 The Contractor shall prepare drawings ("Coordination Drawings") after the Contractor and appropriate Subcontractors ("Coordination Participants") **(1)** determine the sequence of the Project, **(2)** identify the areas requiring special attention ("Coordination Areas"), and **(3)** determine the need for a coordination drawing for any Coordination Area. The Contractor shall prepare the Coordination Drawings with Computer-Aided Design ("CAD") or Building Information Modeling ("BIM") software acceptable to the Contracting Authority. The Coordination Drawings shall show the sheet metal work with plan and elevation dimensions, which specifically locate all HVAC ductwork, HVAC equipment, and HVAC piping for each Coordination Area based upon the information, discussion, and resulting consensus of the Coordination Participants during the coordination meetings.

6.7.1.1 After the Contractor completes the Coordination Drawings, the Contractor shall forward a copy of the Coordination Drawings to the A/E, Contracting Authority, and Owner.

6.7.1.2 The A/E shall review the Coordination Drawings to determine whether the Coordination Participants achieved the goals listed in **Section 6.7.1**. The A/E shall report any concerns, in writing, to the Coordination Participants within 14 days after receiving the drawings.

6.8 Additional Tests and Inspections

6.8.1 If the A/E or the Contracting Authority determines that any portion of the Work requires special inspection, testing, or approval not otherwise required under the Contract Documents, the A/E shall order such inspection, testing, or approval.

6.8.1.1 If the special inspection, testing, or approval reveals Defective Work, the Contractor shall pay all associated costs and will not be entitled to any related adjustment of the Contract Times. Those costs may include, but are not limited to:

- **.1** the cost of the special inspection, testing, or approval;
- **.2** the cost of additional special inspections, testing, or approvals to evaluate remedial Work;
- **.3** the cost of correcting the Defective Work; and
- **.4** all related Owner-incurred fees and charges of contractors, engineers, architects, attorneys, and other professionals.

6.8.1.2 The Contracting Authority may deduct the costs described under **Section 6.8.1.1** from payments then or thereafter due the Contractor. If payments then or thereafter due the Contractor are not sufficient to cover those amounts, the Contractor shall immediately pay the amount of the insufficiency to the Owner.

6.8.1.3 If the special inspection, testing, or approval reveals that the Work complies with the Contract Documents, and the Contractor believes that it is entitled to an adjustment of the Contract Sum or Contract Times, or both, on account of the special inspection, testing, or approval, the Contractor may request a Change Order by giving written notice under **Section 7.3.2** within 7 days after the special inspection, testing, or approval.

6.8.2 If the Contractor is aware of a need for inspection, testing, or approval, or of a need to have any inspection, testing, or approval completed by a particular time to avoid delay, then the Contractor shall timely communicate such information to the A/E and Contracting Authority.

6.8.3 Except as described under **Section 6.8.1**, the Owner shall pay for any inspection, testing, or approval that did not become a requirement until after it awarded the Contract.

6.8.4 The Contractor shall coordinate with and give the A/E, Contracting Authority, and Owner reasonable notice of the anticipated dates of all inspections, testing, or approvals.

6.8.5 Within 5 days after completion of an inspection, testing, or approval, the A/E shall provide an original report/certificate of the inspection, testing, or approval to the Contractor and Contracting Authority with a recommendation for or against acceptance of the results therein.

6.9 Review of Contract Documents and Field Conditions

6.9.1 Before starting each portion of the Work, the Contractor shall carefully study and compare the various Contract Documents relative to that portion of the Work, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the Site affecting it.

6.9.2 If the Contractor finds any perceived ambiguity, conflict, error, omission, or discrepancy on or between any of the Contract Documents, or between any of the Contract Documents and any Applicable Law, the Contractor, before proceeding with the Work, shall promptly submit a Request for Interpretation ("RFI") to the A/E for an interpretation or clarification.

6.9.2.1 Before submitting any RFI to the A/E, the Contractor shall carefully review the Contract Documents to ensure that the Contract Documents do not answer the RFI.

6.9.2.2 The A/E shall respond to an RFI within 3 days of receiving the RFI.

6.9.2.3 Any interpretation or clarification of the Contract Documents made by any Person other than the A/E, or in any manner other than writing, shall not be binding and the Contractor shall not rely upon it.

6.9.3 If the Contractor believes that it is entitled to an adjustment of the Contract Sum or Contract Times, or both, on account of clarifications or instructions issued by the A/E in response to a RFI, the Contractor may request a Change Order by giving written notice under **Section 7.3.2** within 7 days of receiving the A/E's RFI response.

6.9.4 If the Contractor does not notify the A/E per **Section 6.9.3**, the Contractor will have accepted the RFI response without an adjustment to the Contract Sum or Contract Times.

6.10 Protection of the Project

6.10.1 The Contractor shall protect the Work from weather and maintain the Work and all materials, apparatus, and fixtures free from injury or damage until Substantial Completion of the Work.

6.10.1.1 The Contractor shall at all times cover or protect the Work.

6.10.1.2 The Contractor, at its expense, shall remove, and replace with new, any Work damaged as a result of the Contractor's failure to provide coverage or protection.

6.10.1.3 The Contractor, at its expense, shall repair or replace any adjacent property, including, but not limited to, roads, walks, shrubbery, plants, trees, or turf, damaged during performance of the Work.

6.10.1.4 After the date of Substantial Completion of the Work, the Owner is responsible for protecting and maintaining all materials, apparatus, and fixtures for the occupied portion of the Project free from injury or damage.

6.10.2 The Contractor shall protect the Project and existing or adjacent property from damage at all times and shall erect and maintain necessary barriers, furnish and keep lighted necessary danger signals at night, and take reasonable precautions to prevent injury or damage to individuals or property.

6.10.3 The Contractor shall not load, or permit any part of the Project to be loaded, in any manner that endangers the Project, or any portion thereof. The Contractor shall not subject any part of the Project or existing or adjacent property to stress or pressure that endangers the Project or property.

6.10.4 The Contractor shall provide all temporary bracing, shoring, and other structural support required for safety of the Project and proper execution of the Work.

6.10.5 Vibration, Noise, and Dust Control.

6.10.5.1 The Contractor shall provide controls/barriers for vibrations, noise, and dust control in occupied buildings as required by the construction operations.

6.10.5.2 The Contractor will not be permitted to exhaust or release unfiltered air, dust, construction debris, or other undesirable products into the exterior atmosphere or into occupied areas of the building outside the Site. The Project Manager may limit or stop the Work if the Contractor does not maintain proper air-quality standards.

6.10.5.3 In certain occupied buildings, tasks might be of such a nature that noise and vibration cannot be tolerated. In such spaces, Work shall be scheduled for other than normal working hours. The Contractor is cautioned that weekend or overtime work, if required, shall be performed at no additional cost. Permission to work other than standard hours shall be received from the Contracting Authority prior to the occurrence. Weekend and overtime Work shall be reflected in the Construction Progress Schedule.

6.10.5.4 The Contractor is responsible for vibration control and control of transmission of noise arising from the Work. Principal considerations that shall be given to noise and vibration control are:

- **.1** Noise control in compliance with Occupational Safety and Health Administration ("OSHA") requirements for the health and safety of building occupants; control shall be for all areas of the facility, including equipment rooms, boiler rooms, and fan rooms.
- **.2** Vibration control to limit sound produced by construction equipment, and for protection of the equipment existing in a building and the building structure.
- **.3** Vibration control to provide for maximum usefulness of the facility by keeping levels of vibration within ranges conducive to study and work or other uses for which the facility is designed.

6.11 Materials and Equipment

6.11.1 The Contractor shall provide new materials and equipment of the quality specified in the Contract Documents.

6.11.2 The Contractor shall bring to or store at the Site only the materials and equipment required in the Work. If possible, materials and equipment should be installed in their final positions when brought to the Site.

6.11.2.1 The Contractor shall properly store and protect all materials and equipment it provides to the Project.

6.11.2.2 The Contractor shall timely remove from the Site any materials or equipment no longer required for the Work.

6.11.3 The Contractor shall not allow materials or equipment to damage the Project or adjacent property, nor to endanger any individual at or near the Site.

6.11.4 If the Contractor provides an Acceptable Component, the Contractor shall be solely responsible for the costs of coordination and modification required.

6.11.5 If the Contractor provides approved Substitutions that require changes to the Contract Documents, the Contractor shall be solely responsible for the additional costs incurred as a result, including, but not limited to, changes to the design by the A/E.

6.11.6 The A/E shall consider Requests for Substitutions after the bid opening only when the Contractor can conclusively demonstrate to the A/E the following conditions:

6.11.6.1 the specified Basis of Design Components, Acceptable Components, or previously-approved Substitutions, through no fault of the Contractor or a Subcontractor, are not available; or

6.11.6.2 the specified Basis of Design Components, Acceptable Components, or previously-approved Substitutions will not perform as designed or intended.

6.11.7 The Contractor's incorporation of unapproved Substitutions in the Work shall constitute Defective Work.

6.12 Labor

6.12.1 The Contractor shall maintain a sufficient workforce and enforce good discipline and order among its employees and the employees of its Subcontractors. The Contractor shall not permit employment of individuals not skilled in tasks assigned to them.

6.12.2 The Contractor shall dismiss from the Project any individual employed by the Contractor, or a Subcontractor, who the Contracting Authority finds, in its sole discretion, to be incompetent, guilty of misconduct, or detrimental to the Project.

6.12.3 The Contractor shall employ all legal efforts to minimize the likelihood or effect of any strike, Work stoppage, or other labor disturbance. Informational pickets shall not justify any Work stoppage.

6.13 Safety Precautions

6.13.1 The Contractor shall take reasonable precautions to ensure the safety of individuals on the Project.

6.13.1.1 The Contractor is responsible for designing and implementing its own safety program, including compliance with OSHA regulations. The Contractor's safety plans, such as fall protection, hazards, communications, competent person, etc., shall meet or exceed the Owner's safety plan (if any).

6.13.2 The Contractor shall pay any fine or cost incurred because of the Contractor's violation, or alleged violation, of Applicable Law.

6.13.3 Before starting any Work, the Contractor shall submit to the Contracting Authority a copy of the Contractor's site-specific safety plan and safety manuals.

6.13.4 The Contractor shall not introduce Hazardous Materials to the Project or burn any fires on the Site.

6.13.4.1 The Contractor shall notify the Project Manager 24 hours before the start of non-routine or non-recurring hot-work. Use of sources of fire, flame or sparks and flammable materials shall be kept to an absolute minimum. At the beginning of the Project, the Contractor shall inform the Project Manager of its intent to use blowtorches, welding apparatus or similar exposed flame and sparking devices. Similar notice shall be given in regard to the use of flammable liquids, adhesives, and cleaners.

6.13.4.2 The Contractor shall furnish an appropriate number of fire extinguishers (minimum of 1), which shall be within the immediate areas where work is being done at all times. The extinguisher shall be adequate and suitable for the class of fire likely to be caused by the Contractor's operations.

6.13.5 Work Stoppage Due to Hazardous Materials.

6.13.5.1 If the Contractor encounters material the Contractor reasonably believes to be, or contain, a Hazardous Material that has not been rendered harmless, the Contractor shall immediately stop Work in the affected area and verbally report the condition to the Contracting Authority and A/E, and within 1 business day deliver written notice of the condition to the Contracting Authority and A/E.

6.13.5.2 The Contracting Authority will promptly determine the necessity of the Owner retaining a qualified environmental consultant to evaluate the suspected Hazardous Material and to issue a related written report. Where appropriate, the Owner will engage a licensed abatement contractor to remove the material or render it harmless as directed.

6.13.5.3 The Contractor shall resume Work in the affected area upon written notice from the A/E that **(1)** the suspect material was evaluated and found not to be or contain a Hazardous Material, or **(2)** the suspect material has been removed or rendered harmless.

6.13.5.4 If the Contractor knowingly or negligently proceeds with the Work in an area where a Hazardous Material exists and has not been rendered harmless, the Contractor shall be solely responsible for all related claims, damages, losses, and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from performing the Work in the affected area.

6.13.5.5 The term "rendered harmless" means that the level of exposure is less than any applicable exposure standards set forth in Applicable Law.

6.13.6 Safety Data Sheets.

6.13.6.1 The Contractor shall identify any material it uses at the Site with a Safety Data Sheet ("SDS") meeting the requirements of OSHA's Hazard Communication Standard (formerly known as a Material Safety Data Sheet).

6.13.6.2 The Contractor shall maintain a notebook containing all of its applicable SDSs. This notebook shall be kept at the Site for the duration of the Project.

6.14 Construction Facilities, Utilities, and Equipment

6.14.1 Facilities.

6.14.1.1 The Contractor shall provide and maintain in a clean condition suitable temporary facilities, equipment, services, and enclosed storage for its use at the Site.

6.14.1.2 The Contractor shall provide and maintain in a clean condition:

- **.1** suitable facilities, equipment, and services for use by the A/E and Contracting Authority;
- **.2** adequate space, equipment, and furnishings to conduct progress meetings, and store approved documents and permits; and

.3 adequate sanitary facilities for use by all Persons at the Site.

6.14.2 Environmental Controls.

6.14.2.1 The Contractor shall protect its Work and materials from weather and damage from heat, cold, and humidity.

6.14.2.2 Until the permanent HVAC system is complete and available for use:

.1 the Contractor shall make arrangements and pay for installation and maintenance of temporary heating and ventilating systems; and

.2 the Contractor shall pay the costs incurred in operating the temporary heating and ventilating systems.

6.14.2.3 When the permanent HVAC system is complete and available for use:

.1 The Contractor shall start up and maintain operation of the permanent HVAC system, including filters, and promptly remove temporary heating and ventilating systems.

.2 If the Project consists entirely of new construction, the Contractor shall pay the costs of energy consumed in operating the permanent HVAC system until Substantial Completion.

.3 If the Project is a renovation of an existing building or structure, addition(s) to an existing building or structure, or any combination of new construction and renovation work that does not allow separate metering of utilities, the Owner shall pay the costs of energy consumed in operating the permanent HVAC system.

6.14.2.4 From the date of Substantial Completion, the Owner shall pay the cost of operating the permanent HVAC system for the occupied portion of the Project.

6.14.2.5 If the permanent HVAC system is used during construction, the Contractor shall furnish an extended warranty and service contract in effect until the expiration of the Correction Period.

6.14.3 Water and Drainage.

6.14.3.1 The Contractor shall provide water necessary for the Work until the permanent plumbing system is available for use.

6.14.3.2 The Contractor shall provide temporary drainage and dewatering necessary for the Work and shall employ pumps, trenches, drains, sumps, and other necessary elements required to provide satisfactory working conditions for the protection, execution, and completion of the Project.

6.14.3.3 The Contractor shall make arrangements and pay for installation and maintenance of temporary plumbing systems until the permanent plumbing system is available for use.

6.14.3.4 When the permanent plumbing system is complete and available for use:

.1 The Contractor shall start up and maintain operation of the permanent plumbing systems, and make arrangements and pay for removal of temporary plumbing systems.

.2 If the Project consists entirely of new construction, the Contractor shall pay the costs of water consumed and sewerage charges until Substantial Completion.

.3 If the Project is a renovation of an existing building or structure, addition(s) to an existing building or structure, or any combination of new construction and renovation work that does not allow separate metering of utilities, the Owner shall pay the costs of water consumed and sewerage charges.

6.14.3.5 From the date of Substantial Completion, the Owner shall pay the costs of water consumed and sewerage charges for the occupied portion of the Project.

6.14.3.6 If the permanent plumbing system is used during construction, the Contractor shall furnish an extended warranty and service contract in effect until the expiration of the Correction Period.

6.14.4 Electric Service.

6.14.4.1 The Contractor shall provide temporary light and power; pay the charges for temporary electric service installation, and removal if required.

6.14.4.2 If the Project consists entirely of new construction, the Contractor shall pay the cost of energy consumed until Substantial Completion.

6.14.4.3 If the Project is a renovation of an existing building or structure, addition(s) to an existing building or structure, or any combination of new construction and renovation work that does not allow separate metering of utilities, the Owner shall pay the cost of energy consumed.

6.14.4.4 From the date of Substantial Completion, the Owner shall pay the cost of energy consumed for the occupied portions of the Project.

6.14.4.5 If the permanent electrical system is used during construction, the Contractor shall furnish an extended warranty and service contract in effect until the expiration of the Correction Period.

6.14.5 Hoisting Facilities.

6.14.5.1 The Contractor shall erect and maintain any hoisting equipment required for its Work.

6.14.5.2 If the electric service requirements of hoisting facilities differ from that available at the Site, the Contractor shall provide and pay for all necessary connections.

6.14.5.3 If a permanent elevator is identified in the Contract Documents to be used for hoisting materials or personnel during construction, the Contractor shall furnish an extended warranty and service contract in effect until the expiration of the Correction Period.

6.15 Progress Cleaning

6.15.1 The Contractor shall remove all waste materials, rubbish, and mud attributable to the Work to an appropriate disposal location at, or near, the Site.

6.15.2 The Contractor shall perform weekly broom cleaning of hard flooring surfaces in the area of the Work.

6.15.3 The Contractor shall remove, once each working day or as appropriate for the Project, all waste materials and rubbish from the disposal location at, or near, the Site.

6.15.4 The Contractor shall remove, as appropriate for the Project or as the A/E or Owner directs, any waste materials or rubbish from areas adjacent to the Project.

6.15.4.1 The Contractor shall dispose of waste materials, rubbish, and construction debris in a lawful manner in approved recycling facilities or landfills.

6.15.5 If the Contractor fails to clean up during the progress of the Work, the Contracting Authority may clean up on behalf of the Contractor and at the Contractor's expense. If the Contractor fails to maintain the areas adjacent to the Project clean and free of waste materials and rubbish, the Contracting Authority may also direct the local jurisdiction responsible for the area to have the area cleaned to its satisfaction at the Contractor's expense.

6.15.5.1 The Contracting Authority may deduct the cleaning costs from payments then or thereafter due the Contractor. If payments then or thereafter due the Contractor are not sufficient to cover those amounts, the Contractor shall immediately pay the amount of the insufficiency to the Owner.

6.15.6 The Contractor shall remove excavated material and spoil to a suitable off-site location approved by the Contracting Authority.

6.15.6.1 If the Owner designates a location on its property for disposal or storage of clean topsoil and/or subsoil in the Contract Documents, the Contractor shall remove such materials to the designated location.

6.16 Use of Premises

6.16.1 The Contractor shall use corridors, stairs, and elevators as designated by the Contracting Authority. The Contractor shall exercise extreme care to not exceed the carrying capacity of elevators or damage the cab interior in any way.

6.16.2 Loitering or wandering through interior of buildings or exterior grounds outside the limits of the Work will not be permitted.

6.16.3 The Contractor shall confine its apparatus, materials, and the operations of its workers to the limits indicated by law, ordinances, permits and the directions of the A/E or Project Manager.

6.16.4 No signs or advertising of any kind will be permitted on or about the Site, except those appearing on trucks and trailers.

6.16.5 Site Logistics Plan.

6.16.5.1 The Contractor shall prepare a plan of the Site indicating how the Contractor intends to use the Site. The plan should illustrate, as an example, areas to be used for lay down of material and equipment; office and storage trailer locations; vehicular access gates with ingress and egress routes; locations of wheel wash and concrete truck wash out activities; and offloading and hoisting locations.

6.16.6 Smoking and Tobacco Products.

6.16.6.1 All State buildings are smoke free. Smoking will not be permitted in any indoor area. The ban on tobacco products will be observed in all indoor and outdoor areas and parking areas on all State-owned and leased property. The Contractor shall enforce these restrictions on any individual employed by the Contractor, or a Subcontractor.

6.17 Interruption of Existing Services

6.17.1 Whenever it becomes necessary to interrupt existing services in use by the Owner or its tenants, including but not limited to sewer, water, gas, and steam lines, electric, telephone, and cable service, the Contractor shall continue the associated Work on a non-stop 24-hour per day basis until that Work is completed and the service restored, or at an alternate time required by the Contracting Authority.

6.17.2 Before beginning that Work, the Contractor shall apply in writing to, and receive approval in writing from, the Owner, through the A/E, to establish a time when interruption of the service will cause a minimum of interference with the activities of the Owner and its tenants.

6.18 Explosives and Blasting

6.18.1 The Contractor shall not conduct blasting on, or bring explosives to, the Site without the prior written approval of the Contracting Authority, Owner, and other authorities with jurisdiction.

6.18.2 The Contractor shall perform all blasting, storing, and handling of explosives as required under Applicable Law.

6.18.2.1 The Contractor shall carry appropriate liability insurance coverage, as required by the Contract Documents, for its blasting and explosives storage and handling operations. Immediately upon request, the Contractor shall deliver evidence of that insurance to the Contracting Authority.

6.19 Building Commissioning

6.19.1 If the Project scope includes building commissioning, the Contractor shall participate in the Commissioning Process, as prescribed in the Contract Documents.

6.19.2 The Contractor shall permit the A/E, or a third-party Commissioning Agent (“CxA”) if applicable, access to commission performance based equipment, fixtures, and/or systems (e.g., HVAC, fire protection, smoke evacuation, fume hoods, emergency power, etc.), prior to Substantial Completion.

6.19.3 The A/E, or CxA if applicable, shall promptly notify, in writing, the Contractor of any deficiency identified during the Commissioning Process.

6.19.4 To facilitate the Commissioning Process, the Contractor shall submit 4 sets of Operation and Maintenance Manuals for dynamic and engineered systems to the A/E, and CxA if applicable, for approval. This submission shall occur within 30 days following approval of all related Contractor submittals required by the Contract Documents.

6.20 Action Submittals

6.20.1 Submittal Description. Shop Drawings, Product Data, Samples, and other submittals for the A/E’s review and action shall be provided by the Contractor for any item required by the Contract Documents but not fully described in the Contract Documents, unless waived by the A/E, and include, but are not limited to:

6.20.1.1 construction of the various parts, method of joinery, type of materials, grade, quality and thickness of materials, alloy of materials, profiles of all sections, reinforcement, method of hanging doors or installing windows, anchorage, and type and grade of finish;

6.20.1.2 capacities, types of materials and performance charts that are pertinent to the materials, and performance charts that are pertinent to the equipment item; and

6.20.1.3 wiring diagrams, control diagrams, schematic diagrams, working and erection dimensions, arrangement and specifications.

6.20.2 Form of Submittals. The Contractor shall provide a transmittal letter, review and stamp its approval, and transmit the submittals to the A/E in accordance with the submittal schedule established by the A/E and Contractor.

6.20.2.1 The Contractor shall submit a minimum of 1 reproducible and 3 copies of Shop Drawings, and a minimum of 4 copies of any other submittal, except when using the State’s web-based project management software.

6.20.2.2 The data shown on the Shop Drawings shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to communicate to the A/E the materials and equipment that the Contractor proposes to provide.

6.20.2.3 Each Sample shall be identified clearly as to materials, supplier, pertinent data as catalog numbers, the intended use, and other uses as the A/E may require enabling the A/E to review the submittal.

6.20.3 Variation from Contract Documents. If the submittals show variations from the requirements of the Contract Documents, the Contractor shall specifically and clearly identify the variations in its letter of transmittal.

6.20.3.1 Variations that may affect the construction quality, cost or timeline shall be submitted by the A/E to the Contracting Authority for review, and if approved, shall be incorporated into the Work by Change Order.

6.20.3.2 The Contractor shall not be relieved of responsibility for deviations from the Contract Documents by the A/E's approval of submittals.

6.20.3.3 Submittals are not Contract Documents. In the event of conflicts between submittals and the Contract Documents, the Contract Documents take precedence and govern the Work.

6.20.4 Contractor's Submittal Review. The Contractor shall review and stamp "approved" all submittals before forwarding them to the A/E. If it is apparent to the A/E that the Contractor has not reviewed the submittals, or has conducted an incomplete review, the A/E may reject the submittals.

6.20.4.1 The Contractor shall field verify conditions as necessary and make corrections of dimensions, locations of various items, encroachments of work of Separate Contractors, or variations from the requirements of the Contract Documents.

6.20.4.2 If required by the Contract Documents or Applicable Law, the Contractor shall have Shop Drawings or other submittals prepared by Persons possessing expertise and experience in an appropriate trade or profession or by a registered architect, professional engineer, or other professional.

6.20.4.3 By approving and submitting submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements, and field construction criteria related to the associated Work, or shall do so, and has checked and coordinated the information contained within the submittals with the requirements of the Work and of the Contract Documents.

6.20.5 A/E's Submittal Review. The A/E shall review submittals for conformity with design intent within 14 days of receiving them or in accordance with the approved submittal schedule, or other period as mutually agreed by the A/E and Contractor. The A/E's review of submittals is to determine if the items covered by the submittals will, after installation and incorporation into the Work, conform to the Contract Documents and be compatible with the design concept of the Project as a functioning whole.

6.20.5.1 The Contractor shall make corrections required by the A/E and resubmit the required number of corrected copies of submittals until approved, which resubmission shall be acted upon by the A/E within 14 days of receiving them, or other period mutually agreed by the A/E and Contractor.

6.20.5.2 When resubmitting corrected submittals, the Contractor shall direct the A/E's attention to revisions made by noting revisions on the resubmittal.

6.20.5.3 The Contractor shall pay all reasonable costs of the A/E, Owner, and Contracting Authority for attendant delay, interference, hindrance or disruption of the Project due to excessive resubmittals without fault of the A/E, the Owner, or Contracting Authority. Resubmittals in excess of 2 without fault of the A/E, Owner, or Contracting Authority may be determined excessive by the Contracting Authority.

6.20.5.4 The A/E may hold Samples and other submittals used to coordinate finishes, colors, patterns, textures, or other characteristics until submittals for adjacent materials are available. The A/E shall issue a written notice to the Contractor stating that the submittal is being held, within 7 days of receiving it.

6.20.5.5 If coordinating submittals are not received within the period required for action on previously received submittals that are held in accordance with **Section 6.20.5.4**, review of the previously received submittals may be delayed.

6.20.5.6 The A/E's review shall not extend to means, methods, manners, techniques, sequences, or procedures of construction, or to safety precautions or incident programs.

6.20.5.7 The review and approval of a separate item shall not indicate approval of the assembly in which the item functions.

6.20.6 Risk of Nonpayment. The Contractor shall not commence any portion of the Work requiring Shop Drawings, Product Data, Samples, or other submittals until the submittal has been approved by the A/E. If the Contractor starts Work before the A/E's final approval of the submittal, the Contractor does so at its own risk that payment may not be approved by the Contracting Authority or made by the Owner for the related Work.

6.20.7 Equipment Statement. Shop Drawings on equipment shall include the following written statement from the manufacturer of the equipment:

6.20.7.1 "This equipment submitted for approval shall perform as specified when installed in the arrangement shown on this drawing and in the Contract Documents and in conjunction with all other accessories as flues, breechings, piping, controls, and equipment not furnished by this manufacturer, but required as an accessory or supplement to this equipment, providing that the accessory or supplementary items perform as specified and are installed as shown in the Contract Documents."

.1 The Contractor will be deemed to have included the above statement as required even if the associated Shop Drawing does not actually contain the statement.

6.20.7.2 This equipment statement shall not be required for Samples, Product Data, and other standard submittals that are not created specifically for this Project.

6.20.8 Domestic Steel Certifications. The Contractor shall include the following written certifications on the front cover or initial sheet of each structural steel fabrication Shop Drawing, signed and dated prior to fabrication:

6.20.8.1 "Steel Fabricator Certification: The steel fabricator identified below certifies that for this project all load-bearing structural steel has been fabricated or produced, to the best of its knowledge, only from steel made in the United States in accordance with Ohio Revised Code Section 153.011. Further, the steel fabricator hereby certifies that it has read and understands that a monetary penalty for violations may be imposed under the authority of Ohio Revised Code Section 153.99." This certification shall be followed by the name of the fabrication company, name of the company official signing the certification, the signature of that company official, and the date of that signature.

.1 The Contractor will be deemed to have included the above certification as required even if the associated Shop Drawing does not actually contain the certification.

6.20.8.2 "Contractor Certification: The contractor identified below certifies that it has required as a condition of purchase, that for this project all load-bearing structural steel shall be fabricated and produced using, to the best of its knowledge, only steel made in the United States in accordance with Ohio Revised Code Section 153.011. Further, the contractor hereby certifies that it has read and understands that a monetary penalty for violations may be imposed under the authority of Ohio Revised Code Section 153.99." This certification shall be followed by the name of the Contractor company, name of the company official signing the certification, the signature of that company official, and the date of that signature.

.1 The Contractor will be deemed to have included the above certification as required even if the associated Shop Drawing does not actually contain the certification.

6.21 Warranty

6.21.1 The Contractor warrants to the Contracting Authority and Owner that all materials and equipment furnished under the Contract shall be new and of good quality unless otherwise required or permitted by the Contract Documents, that the Work shall be free from defects not inherent in the quality required or permitted, and that the Work shall conform to the requirements of the Contract Documents. Work not conforming to those requirements, including Substitutions not properly approved and authorized, may be considered Defective Work. If required by the A/E, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

6.21.1.1 If the Contractor or a Subcontractor recommends a particular product, material, system, or item of equipment for incorporation into the Project and the Owner accepts that recommendation, the above warranty includes a warranty from the Contractor to the Owner that the recommended product, material, system, or item of equipment is fit and appropriate for the associated purpose.

6.22 Uncovering the Work

6.22.1 If the Contractor covers Work contrary to the requirements of the Contract Documents or contrary to the written request of the Contracting Authority or A/E, the Contractor shall, if the Contracting Authority or A/E requests in writing, uncover that Work for observation, correct it if not in conformity with the Contract Documents, and recover it at the Contractor's expense without adjustment of the Contract Times.

6.22.2 If the Contractor covers Work in accordance with the Contract Documents and not contrary to a request from the A/E or Contracting Authority for an opportunity to observe the Work prior to covering, the Contractor shall, if the A/E requests in writing, uncover that Work.

6.22.2.1 If the uncovered Work is Defective Work, the Contractor shall pay the costs of uncovering, correcting, and recovering the Work and shall not be entitled to an adjustment of the Contract Times.

6.22.2.2 If the uncovered Work is not Defective Work and the Contractor believes that it is entitled to an adjustment of the Contract Sum or Contract Times, or both, on account of the uncovering and recovering of the Work, the Contractor may request a Change Order by giving written notice under **Section 7.3.2** within 7 days after the Contracting Authority or A/E observes the uncovered Work.

6.23 Correction of the Work

6.23.1 Before Substantial Completion.

6.23.1.1 If the Contractor provides Defective Work or fails or neglects to perform the Work in accordance with the Construction Progress Schedule, the Contracting Authority or A/E may issue a written notice to the Contractor and Contractor's Surety directing the Contractor to correct the Defective Work or recover schedule deficiencies. Unless otherwise specified in that written notice, the Contractor shall begin to correct the Defective Work and recover the schedule deficiencies within no more than three days after the Contracting Authority issues the written notice ("72-Hour Notice").

6.23.1.2 If the Contractor fails to promptly commence and diligently pursue correction of Defective Work or recovery of schedule deficiencies required under **Section 6.23.1.1**, the Owner may correct the Defective Work or take action to recover schedule deficiencies without giving further notice to the Contractor or Contractor's Surety.

6.23.2 After Substantial Completion.

6.23.2.1 In addition to the Contractor's other obligations under the Contract Documents, if any of the Work is found to be Defective Work after Substantial Completion, the Contractor shall correct it promptly after receipt of written notice from the A/E, Contracting Authority, or Owner to do so, unless the Contracting Authority and Owner have previously acknowledged and accepted the Defective Work in writing. The A/E, Contracting Authority, or Owner may send a copy of the written notice to the Contractor's Surety, but are not obligated to do so.

6.23.2.2 During the Correction Period. If the Contracting Authority or Owner issues a notice under **Section 6.23.2.1** during the Correction Period, the Owner may correct the Defective Work itself without giving further notice to the Contractor or Contractor's Surety if the Contractor fails to **(1)** notify the Owner in writing of the Contractor's intent to correct the Defective Work within 7 days after the Contracting Authority or Owner issues the notice and **(2)** thereafter promptly commence and diligently pursue correction of Defective Work.

6.23.2.3 The Correction Period:

- **.1** commences on the date of Substantial Completion of the Work or a designated portion of the Work which the Contracting Authority and Owner have agreed to take Partial Occupancy;
- **.2** relates only to the Contractor's specific obligation and opportunity to correct the Work during the Correction Period;
- **.3** does not establish a period of limitation with respect to any of the Contractor's other obligations under the Contract Documents;
- **.4** has no relationship to the time within which the State or Owner may seek to enforce the Contract;
- **.5** does not establish a period of limitation within respect to the commencement of litigation to establish the Contractor's liability under the Contract or otherwise; and
- **.6** shall not be extended by corrective Work performed by the Contractor under this **Section 6.23.2**.

6.23.2.4 After the Correction Period. If the Owner issues notice under **Section 6.23.2.1** after expiration of the Correction Period, the Owner may correct the Defective Work without giving further notice to the Contractor or Contractor's Surety if the Contractor fails to **(1)** notify the Owner in writing of the Contractor's intent to correct the Defective Work within 14 days after the Owner issues the notice and **(2)** thereafter promptly commence and diligently pursue correction of Defective Work.

6.23.3 Emergency Correction of Defective Work.

6.23.3.1 Notwithstanding any other provision of the Contract to the contrary, if in the Contracting Authority or Owner's opinion the Defective Work presents a threat of imminent harm or danger to people, property, or the environment, the Contracting Authority or Owner may order the Contractor to immediately correct Defective Work or the Owner may correct the Defective Work itself without any prior notice to the Contractor or Contractor's Surety.

6.23.4 Responsibility for Costs of Correction.

6.23.4.1 The Contractor shall pay all of the costs and damages associated with the correction of Defective Work and the recovery of schedule deficiencies under this **Section 6.23**. Those costs and damages may include, but are not limited to, the related fees and charges of contractors, engineers, architects, attorneys, and other professionals; and

the cost of correcting or replacing adjacent work. The Contracting Authority may deduct those costs and damages from payments then or thereafter due the Contractor. If payments then or thereafter due the Contractor are not sufficient to cover those amounts, the Contractor shall immediately pay the amount of the insufficiency to the Owner.

6.24 Acceptance of Defective Work

6.24.1 The Owner may accept any Defective Work instead of requiring its removal or correction, in which case the Contract Sum must be equitably reduced as described under **Article 7**.

6.24.1.1 The Owner may only accept Defective Work though a deduct Change Order that makes explicit reference to this **Section 6.24**.

6.24.2 None of the following will constitute **(1)** acceptance of Defective Work, **(2)** a release of the Contractor's obligation to perform the Work in accordance with the Contract, or **(3)** a waiver of any rights set forth in the Contract or otherwise provided by Applicable Law:

6.24.2.1 observations or inspections by the Owner, Contracting Authority, or A/E;

6.24.2.2 the making of any payment;

6.24.2.3 Substantial Completion or the issuance of a Certificate of Substantial Completion;

6.24.2.4 Partial Occupancy and the Owner's use or occupancy of the Work or any part of it;

6.24.2.5 Contract Completion or the issuance of a partial or final Certificate of Contract Completion;

6.24.2.6 any review or approval of a submittal;

6.24.2.7 any inspection, test, or approval by other Persons; or

6.24.2.8 any correction of Defective Work by the Owner.

6.25 Project Document Maintenance and Submittal

6.25.1 During Construction.

6.25.1.1 The Contractor shall maintain in good order at a secure location on the Site:

.1 a complete copy of all Contract Documents; Shop Drawings, Product Data, Samples and similar required submittals; manufacturer operating and maintenance instructions; certificates; warranties; RFIs and responses thereto; and other Project-related documents, all marked currently and accurately to record field changes and selections made during construction and to show actual installation where installation varies from Work as originally shown, including the exact location and depth of underground utility lines; and

.2 a set of Drawings and Specifications, approved in accordance with **Section 5.2.1.1**, and the records required by **Section 6.2.17**.

6.25.1.2 Before submitting each Contractor Payment Request, the Contractor shall record all changes on the Contract Documents, neatly in a contrasting color, noting new information not shown on the original Contract Documents. Failure to record all changes may cause payment to be withheld or delayed by the Contracting Authority.

6.25.1.3 The Contractor shall keep a record of changes made to the Specifications, noting particularly any approved variation from manufacturer's installation instructions and recommendations.

6.25.1.4 If the Contractor uses Shop Drawings to indicate as-built conditions, the Contractor shall cross-reference the Shop Drawing sheet numbers to the corresponding sheet numbers on the Contract Documents. The Contractor shall note related numbers where applicable.

6.25.1.5 The Contractor shall at all times permit access to the documents described in this **Section 6.25.1** to authorized representatives of the State, local authorities having jurisdiction, Contracting Authority, Owner, and A/E.

6.25.2 Before Contract Completion.

6.25.2.1 The Contractor, as a condition precedent to execution of the Certificate of Contract Completion and final payment, shall organize the As-Built Documents into manageable sets, bind the sets with durable paper cover sheets, and deliver the As-Built Documents to the A/E.

6.25.2.2 The Contractor's As-Built Documents submission shall include, but is not limited to:

.1 Certificate of Occupancy;

.2 inspection certificates for pressure piping, elevator, boiler, electrical, plumbing or piping purification, etc.;

.3 Letter of Approval from the local fire authority or State Fire Marshal for the fire suppression system;

.4 Operation and Maintenance Manuals, organized into suitable sets of manageable size. Indexed data bound in individual binders, with pocket folders for folded sheet information and appropriate identification marked on the front and the spine of each binder;

.5 neatly and accurately marked sets of As-Built Documents, and other Contract Documents reflecting the actual construction of the Project;

.6 detailed Drawings reflecting the exact location of any concealed utilities, mechanical or electrical systems, and components;

.7 assignment to the Owner of all warranties and guarantees, including the most-recent address and telephone number of any Subcontractors or manufacturers;

.8 an affidavit to certify that all Subcontractors have been paid in full for all Work performed or materials furnished for the Project;

.9 final certified payroll reports; and

.10 an affidavit to certify that the Contractor and each of its Subcontractors, regardless of tier, have complied with all requirements of ORC Chapter 4115.

6.25.2.3 By submitting the As-Built Documents to the A/E, the Contractor certifies that its As-Built Documents are complete, correct, and accurate.

6.25.3 Record Documents.

6.25.3.1 The A/E shall revise the original Contract Documents and related electronic files with the information contained on the As-Built Documents. The A/E shall label the revised original Contract Documents and related electronic files as "Record Documents" and reflect the date of the A/E's incorporation of the As-Built Documents.

6.25.3.2 The Owner may thereafter use the Record Documents for any purpose relating to the Project including, but not limited to, additions to or completion of the Project.

6.26 Final Cleaning

6.26.1 Before requesting the Substantial Completion inspection of the Work, the Contractor shall clean the Site, remove waste materials and rubbish attributable to the Project, and restore the property to its original condition so that upon Substantial Completion, the premises are ready for occupancy by the Owner.

6.26.2 If the Contractor performs any Work after final cleaning, the Contractor shall clean the affected area as provided above so that upon Substantial Completion, the premises are ready for occupancy by the Owner.

6.26.3 Final cleaning shall be done to the reasonable satisfaction of the A/E and Contracting Authority.

6.27 Substantial Completion

6.27.1 Contractor's Punch List.

6.27.1.1 When the Contractor considers the Work, or a designated portion thereof, Substantially Complete the Contractor shall inspect the Work and prepare a list of Defective Work and incomplete or unacceptable Work ("Contractor's Punch List"). The Contractor shall list all items of Work not in compliance with the Contract Documents, including items the Contractor is requesting to be deferred.

.1 The Contractor shall proceed to correct all items listed on the Contractor's Punch List and certify that the incomplete items listed on the Contractor's Punch List are to its knowledge an accurate and complete list by signing the Contractor's Punch List.

.2 The Contractor's failure to include an item on the Contractor's Punch List shall not alter the Contractor's responsibility to complete the Work in accordance with the Contract Documents.

.3 The Contractor shall submit the signed Contractor's Punch List to the A/E, together with a request for the Substantial Completion inspection of the Work.

6.27.2 Substantial Completion Inspection.

6.27.2.1 Within 3 business days after receipt of the request for the Substantial Completion inspection of the Work, the A/E shall notify the Contractor of acceptance or rejection of the request, stating reasons for any rejection.

.1 Within 7 days after its acceptance of the Contractor's request, the A/E shall conduct the Substantial Completion inspection to determine whether the Work, or designated portion, is in conformity with the Contract Documents and Substantially Complete. The A/E shall notify the Contractor, Contracting Authority, and Owner of the scheduled time of the inspection.

.2 If the A/E determines that the Work is Substantially Complete, within 3 business days after the Substantial Completion inspection, the A/E shall prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion and include a list of Defective, incomplete, or unacceptable Work ("A/E's Punch List"). The A/E's Punch List shall include **(1)** the items on the Contractor's Punch List that are not yet completed or corrected as of the date of the Substantial Completion inspection, and **(2)** comments from the Contracting Authority and Owner.

.3 The A/E shall submit the Certificate of Substantial Completion to the Contracting Authority, Owner, and Contractor for their written acceptance. Upon their acceptance and consent of the Contractor's Surety, and subject to the Owner's right to withhold payment, the Owner shall release retainage as described under **Section 9.7.2**.

.4 The A/E's failure to include an item on the A/E's Punch List shall not alter the Contractor's responsibility to complete the Work in accordance with the Contract Documents.

.5 If the A/E accepts the request and subsequently determines that the Work is not Substantially Complete, the A/E may request compensation for expenses related to excessive Punch List activities. The Contracting Authority may deduct that additional compensation to the A/E from payments then or thereafter due the Contractor. If payments then or thereafter due the Contractor are not sufficient to cover those amounts, the Contractor shall immediately pay the amount of the insufficiency to the Owner.

6.27.3 Completion of Punch List Items.

6.27.3.1 Within 30 days after the date of Substantial Completion and before the date of Final Contract Completion, the Contractor shall complete all items on the A/E's Punch List. After completing all items on the A/E's Punch List, the Contractor shall provide a written request for Final Inspection of the Work to the A/E.

.1 If Work on the A/E's Punch List cannot be timely completed, the Contractor shall justify in writing to the reasonable satisfaction of the Contracting Authority and A/E, the reasons the items cannot be completed, and the Contractor may propose, for the Contracting Authority and A/E's approval, a time when the Contractor shall complete those items.

.2 Within 3 business days after receipt of the request for the Final Inspection of the Work, the A/E shall complete a Final Inspection of the Work for compliance with the Contract Documents.

.3 If multiple inspections of items on the A/E's Punch List are required due to the Contractor's failure to properly and timely complete them, the Contractor shall pay any additional costs incurred by the A/E, Owner, and Contracting Authority resulting from any attendant delay. The Contracting Authority may deduct those additional costs from payments then or thereafter due the Contractor. If payments then or thereafter due the Contractor are not sufficient to cover those amounts, the Contractor shall immediately pay the amount of the insufficiency to the Owner.

6.28 Partial Occupancy

6.28.1 The Owner may occupy or use a portion of the Project prior to Contract Completion if:

6.28.1.1 the building authority with jurisdiction over the Project issues a partial certificate of occupancy for the portion of the Project the Owner intends to occupy;

6.28.1.2 the A/E with the Owner's assistance has provided written notice of the Partial Occupancy to the insurers providing property insurance for the Project; and

6.28.1.3 the Contracting Authority has received notice of the Partial Occupancy from the A/E and has consented to it.

6.28.2 Before the Owner commences Partial Occupancy, the Owner, Contracting Authority, A/E, and Contractor shall proceed as described under **Section 6.27** for the area designated for Partial Occupancy.

6.28.3 The Contractor shall be relieved of the obligation to maintain the area accepted for Partial Occupancy, but shall remain obligated to complete and correct the Work and to carry the insurance required by the Contract Documents during performance of any such Work.

6.29 Demonstration and Training, Operating Appurtenances

6.29.1 The Contractor, as a condition precedent to execution of the Certificate of Contract Completion and final payment, shall perform demonstration and training of the Owner's maintenance personnel as specified in the Contract Documents.

6.29.2 The Contractor, as a condition precedent to execution of the Certificate of Contract Completion and final payment, shall organize and submit operating appurtenances and loose items related to operation and maintenance of the completed Project to the Owner, including, but not limited to:

6.29.2.1 keys to door and window hardware, panels, and other devices not directly provided to the Owner from the manufacturer;

6.29.2.2 operating handles, levers, cranks, specialized wrenches or drivers, remote controls, and similar items; and

6.29.2.3 extra materials (e.g., attic stock).

6.30 Contract Completion

6.30.1 Partial Contract Completion.

6.30.1.1 When items of Work cannot be completed until a subsequent date, the A/E shall prepare a partial Certificate of Contract Completion that shall include a detailed list of the deferred Work and the date(s) by which the Contractor will complete that Work.

6.30.1.2 The A/E shall submit the partial Certificate of Contract Completion to the Contracting Authority, Owner, and Contractor for their written acceptance. Upon their acceptance of the partial Certificate of Contract Completion and consent of the Contractor's Surety, the Contracting Authority may release payment to the Contractor, as determined in the sole discretion of the Contracting Authority.

6.30.2 Final Contract Completion.

6.30.2.1 When all items on the A/E's Punch List have been completed to the satisfaction of the A/E, all requirements of the Contract Documents have been completed, and the provisions of **Sections 6.25** through **6.29** have been fulfilled, the A/E shall prepare and recommend execution of a final Certificate of Contract Completion.

6.30.2.2 The date that the Contracting Authority executes the final Certificate of Contract Completion is the date of Contract Completion.

ARTICLE 7 - MODIFICATIONS

7.1 General

7.1.1 Changes in the Work.

7.1.1.1 The Contracting Authority may order changes in the Work without invalidating the Contract. Subject to the limitations stated in this **Article 7** and elsewhere in the Contract Documents, a change in the Work may be accomplished by a Change Order, Change Directive, or order for a minor change in the Work.

- **.1** The Contractor shall proportionately increase the amount of the Bond whenever the Contract Sum is increased.
- **.2** If notice of any change affecting the Contract is required by the provision of any Bond, notice is the Contractor's responsibility, and the amount of each applicable Bond shall be adjusted accordingly.

7.1.1.2 The Contractor shall not proceed with any change in the Work without the Contracting Authority's prior written authorization except as provided under **Sections 1.10** and **7.5**.

7.1.1.3 Except as provided in **Section 1.10**, the Contractor's failure to obtain prior written authorization for a change in the Work constitutes a waiver by the Contractor of an adjustment to the Contract Sum or Contract Times, or both, for the related Work.

7.1.1.4 The Contractor shall perform all changes in the Work under the applicable provisions of the Contract Documents, and the Contractor shall proceed promptly with the change unless otherwise provided in the Change Order, Change Directive, or order for a minor change in the Work

7.1.2 Paperwork Consolidation.

7.1.2.1 Related Modifications, with the same or similar justification (e.g., Owner Request or field resolution), may be consolidated into the same Change Order.

7.1.2.2 Add and deduct Modifications, with the same or similar justification, may be included on the same Change Order.

7.1.2.3 Modifications resulting from errors or omissions shall not be combined with other modifications for which the A/E will receive a fee.

7.1.3 Modification Numbering.

7.1.3.1 The A/E shall assign a number to each Modification, which shall uniquely identify it.

7.1.3.2 The A/E shall not duplicate or reuse any number throughout the Project or reuse assigned numbers for Proposal Requests that are initiated but cancelled in process.

7.1.3.3 The number for each Change Order shall be coordinated with any associated Proposal Request or Change Directive.

7.1.4 Modification Log.

7.1.4.1 The A/E shall create and maintain a Modification Log for the Project, which shall contain the following minimum information:

- **.1** number of the Modification;
- **.2** a brief description of the Modification;
- **.3** cost of the Modification;
- **.4** schedule impact of the Modification; and
- **.5** dates sent to, and received from, the parties.

7.1.5 Reconciliation of Unit Price Items.

7.1.5.1 The Contracting Authority may increase, decrease, or delete entirely the scheduled quantities of Work to be performed and materials to be furnished by Change Order.

7.1.5.2 The A/E shall issue a Change Order to reconcile the difference between the scheduled and actual quantities of Work performed and materials furnished.

7.1.5.3 If the actual quantity of a Unit Price item differs from the scheduled quantity by 20 percent or more, so that application of the Unit Price to the quantities of Work proposed would create an undue hardship on either the Owner or Contractor, the A/E shall issue a Proposal Request and subsequent Change Order to adjust the Unit Price.

- **.1** If a Unit Price is adjusted as described under **Section 7.1.5.3**, the new Unit Price will only apply to the units of Work performed that are **(1)** less than the 20 percent threshold if the Unit Price is changed on account of an over-estimation of the scheduled quantity of a Unit Price item involved in the Work or **(2)** in excess of the 20 percent threshold if the Unit Price is changed on account of an under-estimation of the scheduled quantity of a Unit Price item involved in the Work.

7.1.5.4 If the actual quantity of a Unit Price item exceeds the scheduled quantity by 20 percent or more, the Contractor shall immediately notify the A/E, who shall issue a Change Directive and subsequent Change Order to authorize an adjustment in the scheduled quantity.

7.2 Change Order Procedure

7.2.1 A Change Order is a written instrument prepared by the A/E and executed by the Contracting Authority and Contractor, stating their agreement upon all of the following:

7.2.1.1 a change in the Work;

7.2.1.2 the amount of the adjustment of the Contract Sum, if any; and

7.2.1.3 the extent of the adjustment of the Contract Times, if any.

7.2.2 Except with the Contracting Authority's written consent as explicitly provided under **Section 7.4.8**, the Contractor is not entitled to reserve any rights or take other similar action with respect to a Change Order if the effect or intent of the reservation or action would be to accommodate a further adjustment of the Contract Sum or Contract Times, or both, after the Contractor signs the Change Order. By signing a Change Order, the Contractor irrevocably certifies that the elements of a Change Order described in **Section 7.2.1** are completely satisfied, and waives all rights, if any, to seek further adjustment of the Contract Sum or Contract Times, or both, at a later date with respect to the associated change in the Work including without limitation on account of the "cumulative impact" of the associated change in the Work in combination with one or more other changes in the Work.

7.2.3 The A/E shall prepare each Change Order form, attach the supporting documentation, and issue the Change Order to the Contractor for signature.

7.2.4 If the Contractor is in agreement with the Change Order under **Section 7.2.1**, the Contractor shall sign and return the Change Order to the A/E within 3 days after receiving it.

7.2.5 When the A/E receives the Change Order signed by the Contractor, the A/E will recommend approval by signing the form and transmitting the Change Order and the revised Change Order Log to the Owner.

7.2.6 When the Owner receives the Change Order, the Owner may sign the form accepting the Change Order, attach certification of funding, and transmit the Change Order to the Contracting Authority; or, if the Owner does not accept the Change Order, the Owner will reject and return it to the A/E.

7.2.7 When the Contracting Authority receives the Change Order, the Contracting Authority may sign the form approving the Change Order, and transmit the fully executed Change Order to all signers; or, if the Contracting Authority does not accept the Change Order, the Contracting Authority will reject and return it to the A/E.

7.2.8 When the Change Order is signed by the Contractor, A/E, Owner, and Contracting Authority, the fully executed Change Order modifies the Contract Documents and authorizes and directs the Contractor to proceed, and the Contractor shall promptly proceed with the associated change in the Work.

7.3 Initiation of Change Orders

7.3.1 Proposal Request.

7.3.1.1 The A/E shall prepare and issue a Proposal Request to the Contractor to obtain the Contractor's Proposal for the adjustment of the Contract Sum or the Contract Times, or both, associated with a contemplated Modification.

- **.1** In any Proposal for an adjustment of the Contract Sum, the Contractor shall specifically identify the items set forth in **Section 7.7**.
- **.2** In any Proposal for an adjustment of the Contract Times, the Contractor shall specifically identify the items set forth in **Section 7.8**.
- **.3** The Contractor's cost of preparing and providing Proposals is included in the Contract Sum.

7.3.1.2 The Contractor shall respond with a Proposal to the A/E and Contracting Authority within 14 days after receiving the Proposal Request. The allowable time for the Contractor's response may be extended by written agreement of the Contractor and A/E.

7.3.1.3 The Contractor shall hold the Proposal valid and open for acceptance for at least 45 days. The acceptance period may be adjusted by mutual consent of the Contractor and Contracting Authority. The time limits described under this **Section 7.3.1.3** apply only to Proposals submitted in response to a Proposal Request.

7.3.1.4 A Proposal may be accepted by the Contracting Authority only through a Change Order. A Proposal Request does not authorize the Contractor to proceed with a change in the Work.

7.3.1.5 If the Contractor does not timely submit a Proposal within the time required in **Section 7.3.1.2**, the Contractor waives its right to an adjustment to the Contract Sum or Contract Times, or both, associated with the contemplated change in the Work.

7.3.2 Request for Change Order.

7.3.2.1 The Contractor may initiate a change in the Work by submitting written notice to the A/E accompanied by a Proposal meeting the requirements of **Section 7.3.1**.

7.4 Change Directives

7.4.1 A Change Directive is a written order prepared by the A/E and executed by the Contracting Authority directing a change in the Work and may, if necessary:

7.4.1.1 state a proposed basis for adjustment, if any, in the Contract Sum or Contract Times, or both; or

7.4.1.2 limit the scope of the change in the Work on a time and materials basis, not to exceed a fixed adjustment of the Contract Sum.

7.4.2 If a change in the Work must start immediately to avoid an imminent impact to the schedule of the Project, the A/E may prepare a Change Directive for the Contracting Authority's and the Owner's signatures pursuant to **Section 7.4.1**, authorizing the Contractor to proceed.

7.4.3 A Change Directive shall be used to direct a change in the Work in the absence of total agreement on the terms of a Change Order.

7.4.3.1 For the purposes of clarity, the Contract refers to a Change Directive as if it is only to be used in the absence of total agreement on the terms of a Change Order concerning the associated change of the Work. A Change Directive may also be used in the absence of agreement as to whether the subject of the Change Directive actually constitutes a change in the Work; such as the situation described under **Section 7.5.3**.

7.4.4 Upon receipt of a Change Directive, the Contractor shall promptly proceed with the change in the Work involved.

7.4.5 The Contractor may sign the Change Directive to accept the proposed basis for adjustment, if any, of the Contract Sum or Contract Times, or both. Thereafter, the A/E shall prepare and the A/E, Contracting Authority, Owner, and Contractor shall promptly execute an associated Change Order as described under **Section 7.2**.

7.4.6 Within 14 days after receiving the Change Directive, the Contractor shall respond with a Proposal meeting the requirements of **Section 7.3.1** to the A/E and Contracting Authority for adjustment of the Contract Sum or Contract Times, or both, on account of the change, unless the Change Directive is performed on a time and materials basis under **Section 7.4.1.2**. If the Change Directive is performed on a time and materials basis, the Contractor shall submit its Proposal within 7 days after completing the Work.

7.4.6.1 The Proposal for the adjustment of the Contract Sum, if any, shall include: **(1)** written documentation as described under **Section 7.7**; and **(2)** a written statement from the Contractor that the proposed adjustment is the entire adjustment in the Contract Sum associated with the change.

7.4.6.2 The Proposal for the change in the Contract Times, if any, shall include: **(1)** written documentation as described under **Section 7.8**; and **(2)** a written statement from the Contractor that the proposed adjustment is the entire adjustment of the Contract Times associated with the change.

7.4.7 If the Contractor does not respond to a Change Directive as required under **Section 7.4.5** or **Section 7.4.6**, the Contracting Authority shall determine the adjustments, if any, of the Contract Sum and Contract Times. If the Contractor does not agree with the Contracting Authority's determination, the Contractor shall initiate a Claim under **Article 8** within 10 days of the date that the Contracting Authority issues its determination, and the Contractor's failure to do so shall constitute an irrevocable waiver of the Claim.

7.4.8 Pending final determination of the total adjustment of the Contract Times on account of a Change Directive, the period of time not in dispute for that change in the Work may be included in the Construction Progress Schedule accompanied by a Change Order indicating the parties' agreement with part or all of the time adjustment.

7.4.9 If the Contracting Authority, Owner, and Contractor agree on the adjustments of the Contract Sum and Contract Times associated with a Change Directive, the A/E shall prepare an appropriate Change Order within 7 days after receiving the Contractor's Proposal. The A/E, Contracting Authority, Owner, and Contractor shall promptly sign the Change Order as described under **Section 7.2**.

7.4.10 If the Contracting Authority, Owner, and Contractor do not agree on the adjustments of the Contract Sum and Contract Times associated with a Change Directive within 60 days after the Change Directive is issued, the Contracting Authority shall determine the adjustments, if any, of the Contract Sum and Contract Times. If the Contractor does not agree with the Contracting Authority's determination, the Contractor shall initiate a Claim under **Article 8** within 10 days of the date that the Contracting Authority issues its determination, and the Contractor's failure to do so shall constitute an irrevocable waiver of the Claim.

7.5 Minor Changes in the Work

7.5.1 The A/E may order minor changes in the Work not involving adjustment of the Contract Sum or extension of the Contract Times and not inconsistent with the intent of the Contract Documents. Those changes shall be effected by written order issued to the Contractor.

7.5.2 The Contractor shall promptly carry out each order for a minor change in the Work if the Contractor agrees that the order does not involve adjustment of the Contract Sum or Contract Times, or both.

7.5.3 If the Contractor reasonably believes that it would be entitled to an adjustment of the Contract Sum or Contract Times, or both, on account of an order for a minor change in the Work, the Contractor, within 3 business days after receiving the order, shall give the Contracting Authority and A/E written notice of the Contractor's position, and not proceed with the subject Work without first receiving a Change Directive or Change Order related to it.

7.5.4 The Contractor waives its right to an adjustment of the Contract Sum or Contract Times on account of an order for a minor change in the Work by:

7.5.4.1 starting the Work that is the subject of the order for a minor change in the Work; or

7.5.4.2 failing to give the notice described under **Section 7.5.3** within 3 business days after receiving the order for a minor change in the Work.

7.6 Differing Site Conditions

7.6.1 If the Contractor encounters a Differing Site Condition, the Contractor shall stop Work on that Differing Site Condition and give immediate written notice of the condition to the A/E and Contracting Authority.

7.6.1.1 The Contractor's failure to give notice of the Differing Site Condition as required under this **Section 7.6.1** shall constitute an irrevocable waiver of any associated Claim.

7.6.1.2 The written notice of a Differing Site Condition under this **Section 7.6.1** shall be required before the notice of Claim under **Article 8**.

7.6.2 Promptly after receiving notice from the Contractor under **Section 7.6.1**, the A/E shall investigate to determine whether the Contractor has encountered a Differing Site Condition. The A/E shall give written notice of its determination to the Contracting Authority and Contractor within 10 days after completing the investigation.

7.6.2.1 If the A/E determines that the Contractor has encountered a Differing Site Condition and the Contracting Authority agrees with the A/E's determination, the A/E shall process an appropriate Change Order.

7.6.2.2 If the A/E determines that the Contractor has encountered a Differing Site Condition but the Contracting Authority disagrees with the A/E's determination, the A/E shall process an appropriate Change Directive through which the Contracting Authority may convey its disagreement with the A/E's determination.

7.6.2.3 If the A/E determines that the Contractor has not encountered a Differing Site Condition and the Contractor does not agree with that determination, the Contractor must initiate a Claim under **Article 8** within 10 days of the date that the A/E issues its determination.

7.7 Change Order Cost or Credit Determination

7.7.1 General.

7.7.1.1 The maximum cost or credit resulting from a change in the Work shall be determined as described below.

- **.1** Proposals shall include the information required by **Section 7.7.1.4**.
- **.2** A Unit Price Proposal shall only be valid when incorporated into the Contract by Change Order.
- **.3** The maximum cost or credit includes all compensation for impact costs. Additional costs for impacts shall not be allowed.

7.7.1.2 The Contractor shall not assign any portion of the Work to another Person whereby the Contractor would benefit directly or indirectly from the double application of charges for overhead or profit.

7.7.1.3 The Contracting Authority may require notarized invoices for material costs and may audit the records of the Contractor and Subcontractors.

7.7.1.4 For each change in the Work, the Contractor shall furnish a detailed Proposal itemized on the **Proposal Worksheet Summary Form (Contractor)** published by the Ohio Facilities Construction Commission through which the Contractor shall document the related changes in the Contract Sum as described under **Section 7.7.2**. Any Subcontractor pricing shall be itemized on the appropriate **Proposal Worksheet Summary Form**.

7.7.1.5 Section 7.7.2 establishes the exclusive and maximum amount that the Owner shall pay for any Change Order, including, but not limited to, all amounts for interference with, delay, hindrance, disruption, or impact of the Work ("Pricing Criteria"). These Pricing Criteria also govern the value of deduct Change Orders and the Contractor's entitlement to additional compensation or damages through the Claims and dispute resolution processes on account of changes in the Work. In order to expedite the review and approval process, Proposals shall be prepared in the categories and order listed in **Section 7.7.2**.

7.7.2 Pricing Criteria.

7.7.2.1 Contractor Personnel Costs: The Contractor's on-Site management (including supervision and administrative personnel) not subject to prevailing wage under ORC Chapter 4115. These costs will be calculated on an hourly basis according to the rates acceptable to the Contracting Authority.

- **.1** In no event will the Contractor be entitled to an increase in the Contract Sum on account of Contractor Personnel Costs unless the Contractor actually incurs additional Contractor Personnel Costs solely on account of the associated change in the Work.
- **.2** Under no conditions will the increase under this **Section 7.7.2.1** exceed those additional Contractor Personnel Costs the Contractor actually incurs.

7.7.2.2 Labor: Field labor directly involved in the Work based upon the actual rate of pay to the worker. If the Project is subject to payment of prevailing wage rates, field labor shall be paid according to the relevant

classification of labor as established in the applicable prevailing wage determination for the Project locality, as determined by the Ohio Department of Commerce, Wage and Hour Bureau.

.1 In no event will the Contractor be entitled to an increase in the Contract Sum on account of labor costs unless the Contractor actually incurs additional labor costs solely on account of the associated change in the Work.

.2 Under no conditions will the increase under this **Section 7.7.2.2** exceed those additional labor costs the Contractor actually incurs.

.3 The cost for supervision above the level of working forepersons (such as general forepersons, superintendent, project manager, etc.) is included in the adjustment under **Section 7.7.2.1** for the Contractor and under **Section 7.7.2.10** for Subcontractors.

7.7.2.3 Fringes: Fringe benefit credit for labor provided under **Section 7.7.2.2** is only allowable for prevailing wage fringe benefits pursuant to ORC Chapter 4115, including, but not limited to, Health and Welfare, vacation, apprenticeship training, and certain types of pension plans. The parties shall defer to the Ohio Department of Commerce's policy on which benefits are granted fringe benefit credit. Each fringe benefit for which credit is requested shall be calculated on an hourly basis and listed as a separate line item. The Contractor shall submit documentation supporting the calculation of the amounts for each fringe benefit for each worker classification, including labor provided by Subcontractors.

7.7.2.4 Allowable Payroll Expenses: Allowable payroll expenses for labor provided under **Section 7.7.2.2** including payroll taxes as well as other benefits that are required by Applicable Law, such as federal and state Unemployment and Workers' Compensation shall each be a separate line item and shall not be credited for compliance with ORC Chapter 4115.

7.7.2.5 Equipment Rentals: All charges for certain non-owned heavy or specialized equipment at up to 100 percent of the documented rental cost. No rental charges shall be allowed for hand tools, minor equipment, simple scaffolds, etc. Downtime due to repairs, maintenance and weather delays shall not be allowed. Contractor shall submit copies of actual paid invoices to substantiate rental costs.

7.7.2.6 Owned Equipment: All charges for certain heavy or specialized equipment owned by the Contractor or Subcontractor performing the Work at up to 100 percent of the cost listed by the current edition of the Associated Equipment Distributors' *AED Green Book* heavy equipment rental rates. No recovery shall be allowed for hand tools, minor equipment, simple scaffolds, etc. The longest period of time that the equipment is to be required for the Work shall be the basis for the pricing. Downtime due to repairs, maintenance, and weather delays shall not be allowed.

7.7.2.7 Trucking: A reasonable delivery charge or per-mile trucking charge for delivery of required materials or equipment. Charges for use of a pick-up truck shall not be allowed.

7.7.2.8 Materials: The actual cost (including all discounts, rebates or related credits) of all materials incorporated into the changed Work. Documentation shall show costs, quantities, or Unit Prices of all items, as appropriate.

.1 The cost or credit for reusable materials (e.g., concrete form lumber, shoring, or temporary enclosures) shall be limited to 33 percent of the material cost for each use.

7.7.2.9 Contractor's General Conditions Costs: The Contractor's General Conditions Costs to the extent attributable to an associated change in the Contract Time for achievement of Substantial Completion resulting from the change in the Work.

.1 In no event shall the Contract Sum adjustment per day of Contract Time adjustment exceed an amount equal to **(1)** the sum of the General Conditions Costs line items in the Contractor's Schedule of Values approved by the Contracting Authority, **(2)** divided by the total number of days of the original Contract Time for achievement of Substantial Completion.

.2 The Contractor shall **(1)** exclude the Bond premium from the Schedule of Values for the purposes of the calculation under **Section 7.7.2.9.1**, and **(2)** include the actual adjustment of the Bond premium attributable to an associated change in the Contract Sum.

.3 If the Contractor purchases the builder's risk insurance for the Project, the Contractor shall **(1)** exclude the builder's risk insurance premium from the Schedule of Values for the purposes of the calculation under **Section 7.7.2.9.1**, and **(2)** include the actual adjustment of the builder's risk insurance premium attributable to an associated change in the Contract Sum.

7.7.2.10 Subcontractor Overhead and Profit: Adjustment of the Contract Sum on account of a change in Subcontractor-performed Work shall include the Subcontractor's aggregate overhead and profit allowance equal to

15 percent of the sum of the Subcontractor's costs described under **Sections 7.7.2.2** through **7.7.2.8** that are associated with that changed Work.

.1 The allowance applies to each Subcontractor tier.

.2 The allowance covers: the costs required to schedule and coordinate the Work, telephone, telephone charges, facsimile, telegrams, postage, photos, photocopying, hand tools, simple scaffolds (one level high), tool breakage, tool repairs, tool replacement, tool blades, tool bits, home office estimating and expediting, home office clerical and accounting support, home office labor (management, supervision, engineering), all other home office expense, legal services, travel, and parking expenses.

.3 An exception is allowed for shop or engineering labor on items in **Section 7.7.2.10.2**, which shall not be subject to Prevailing Wage rates for steel fabricators, sheet metal fabricators, and sprinkler system fabricators performing work off-site. Recovery for these matters shall be allowed on an hourly basis under items in **Sections 7.7.2.2**, **7.7.2.3**, and **7.7.2.4** of these Pricing Criteria.

.4 An exception is allowed for field supervision labor on items in **Section 7.7.2.10.2**, for those portions of the Change Order Work that will be performed, or was performed, at times when the superintendent is not required to be on site under **Section 6.4**, including but not limited to overtime hours due to acceleration and extensions of the Contract Times. Recovery for this matter will be allowed on an hourly basis under items in **Sections 7.7.2.2**, **7.7.2.3**, and **7.7.2.4** of these Pricing Criteria.

7.7.2.11 Contractor's Fee: Adjustment of the Contract Sum on account of a change in the Work shall include an allowance for the Contractor's Fee equal to 10 percent of the sum of the costs described under **Sections 7.7.2.1** through **7.7.2.10** that are associated with that changed Work.

7.7.2.12 Miscellaneous: Adjustment of the Contract Sum on account of a change in Work may include the following costs with no allowance for Contractor's Fee under **Section 7.7.2.11** or Subcontractor overhead and profit under **Section 7.7.2.10**.

.1 The premium portion only for approved overtime (labor and fringes). The straight time portion is included in items in **Sections 7.7.2.2**, **7.7.2.3**, and **7.7.2.4**.

.2 State sales tax shall be allowed on items as defined by **Section 12.7**.

7.7.3 Costs that shall not be reimbursed for Change Order Work include the following:

7.7.3.1 Voluntary employee deductions including, but not limited to, deductions for charitable donations or U.S. savings bonds.

7.7.3.2 Employee profit sharing.

7.8 Time Extension

7.8.1 Every adjustment of the Contract Times associated with any change in the Work shall be determined as provided in this **Section 7.8**, which establishes the Contractor's maximum entitlement for any change in the Work, including without limitation all adjustments for interference, delay, hindrance, or disruption of the Work. This **Section 7.8** also governs time adjustments for deduct Change Orders and the Contractor's entitlement to additional time through the claims and dispute resolution processes on account of changes in the Work.

7.8.2 The Contractor shall substantiate all changes in the Contract Times with:

7.8.2.1 a written description of the nature of the interference, disruption, hindrance or delay;

7.8.2.2 identification of Persons and events responsible for the interference, disruption, hindrance or delay;

7.8.2.3 date, or anticipated date, of commencement of the interference, disruption, hindrance or delay;

7.8.2.4 identification of activities by schedule activity number and name on the Construction Progress Schedule, which may be affected by the interference, disruption, hindrance or delay, or new activities created by the interference, disruption, hindrance or delay and the relationship with existing activities;

7.8.2.5 anticipated duration of the interference, disruption, hindrance or delay and of any remobilization period;

7.8.2.6 specific number of days of extension requested and specific number of days for remobilization requested;

7.8.2.7 recommended action to avoid or minimize any future interference, disruption, hindrance or delay; and

7.8.2.8 a detailed written proposal as described under **Section 7.7** for an increase in the Contract Sum which would fully compensate the Contractor for all costs of acceleration of the Work needed to completely overcome the associated delay, if any.

7.8.3 Critical Path. Time extensions shall depend upon the extent to which the Work on the critical path of the Construction Progress Schedule is affected, if applicable.

7.8.3.1 A Change Order granting a time extension may provide that the Contract Times shall be extended for only those specific elements so interfered with, disrupted, hindered, or delayed and related remobilization and that remaining Milestone dates shall not be altered and may further provide for adjustment of Liquidated Damages.

7.9 Examination and Audit of Contractor's Records

7.9.1 The Contracting Authority and Owner may examine all books, records, documents and other data of the Contractor and its Subcontractors related to the bidding, pricing, or performance of the Work for the purpose of evaluating any Contractor Payment Request, Proposal, Modification, or Claim.

7.9.2 The above referenced materials shall be made available at the office of the Contractor or Subcontractor, as applicable, at all reasonable times for inspection, audit, and reproduction until the expiration of 6 years after the date of Substantial Completion of all Work.

7.9.2.1 The Contractor shall maintain, and require its Subcontractors to maintain, complete and accurate business records at its principal place of business. If the principal place of business is greater than 50 miles from the Site, the Contractor shall timely make records available, and shall require its Subcontractors to timely make records available, at the office of the Contracting Authority or Owner upon request for the records.

7.9.3 To the extent that the Contractor or Subcontractor, as applicable, informs the Contracting Authority or Owner in writing that any documents provided to the Contracting Authority or Owner are trade secrets, the Contracting Authority or Owner shall treat these documents, to the extent permitted by law, as trade secrets of the Contractor or Subcontractor, as applicable.

7.9.3.1 If a dispute arises with any other Person about whether that Person should be given access to the documents, the Contractor or Subcontractor as applicable, shall indemnify the Contracting Authority and Owner against all costs, expenses, and damages, including but not limited to attorneys' fees, incurred or paid by reason of that dispute.

7.9.4 The right of inspection, audit, and reproduction extends to all documents necessary to permit adequate evaluation of the cost of pricing data submitted along with the computations and projections used therein.

7.9.5 If the Contract has been terminated, in whole or in part, the records relating to the Work terminated shall be made available to the Contracting Authority or Owner for a period of 6 years from the date of any applicable final settlement or payment, as applicable.

7.9.6 Records that relate to disputes, litigation, or settlement of Claims arising out of the performance of the Work shall be made available until the dispute, litigation or Claims have been finally decided or settled.

ARTICLE 8 - DISPUTE RESOLUTION

8.1 Initiation of a Claim

8.1.1 Every Claim shall accrue upon the date of occurrence of the event giving rise to the Claim.

8.1.2 Except as provided under **Section 1.10**, the Contractor shall initiate every Claim by giving written notice of the Claim to the A/E and Contracting Authority within 10 days after occurrence of the event giving rise to the Claim, with the following exceptions:

8.1.2.1 The 10-day time limit on initiating a Claim arising from a determination of the Contracting Authority concerning a Change Directive begins to run on the date that the Contracting Authority issues its determination under **Section 7.4.7** or **Section 7.4.10**, as applicable.

8.1.2.2 The 10-day time limit on initiating a Claim arising from the response of the A/E to a RFI begins to run on the date that the A/E issues the A/E's response to the RFI.

8.1.2.3 The 10-day time limit on initiating a Claim arising from the A/E's determination concerning a Differing Site Condition begins to run on the date that the A/E issues the A/E's determination under **Section 7.6**.

8.1.3 The Contractor's written notice of a Claim shall provide the following information to permit timely and appropriate evaluation of the Claim, determination of responsibility, and opportunity for mitigation:

8.1.3.1 nature and anticipated amount of the impact, including all costs for any interference, disruption, hindrance, or delay, which shall be calculated in accordance with **Section 7.7** and be a fair and reasonably accurate assessment of the damages suffered or anticipated by the Contractor;

8.1.3.2 identification of the circumstances responsible for causing the impact, including, but not limited to, the date or anticipated date, of the commencement of any interference, disruption, hindrance, or delay;

8.1.3.3 identification of activities on the Construction Progress Schedule that will be affected by the impact or new activities that may be created and the relationship with existing activities;

8.1.3.4 anticipated impacts and anticipated duration of any interference, disruption, hindrance, delay, or impact, and any remobilization period; and

8.1.3.5 recommended action to avoid or minimize any interference, disruption, hindrance, delay, or impact.

8.1.4 The Contractor's failure to initiate a Claim as and when required under this **Section 8.1** shall constitute the Contractor's irrevocable waiver of the Claim.

8.1.5 The A/E, in consultation with the Contracting Authority, shall respond to the written notice of the Claim within a reasonable time of receipt, but not to exceed 10 days.

8.2 Substantiation of Claims

8.2.1 Within 30 days after the initiation of a Claim, the Contractor shall submit 4 copies of all information and statements required to substantiate a Claim as provided in this **Article 8** and all other information that the Contractor believes substantiates the Claim. The Contractor shall file the 4 copies by delivery of 1 copy to the A/E, 1 copy to the Owner, and 2 copies to the Contracting Authority.

8.2.2 The Contractor shall substantiate all of its Claims by providing the following minimum information:

8.2.2.1 a narrative of the circumstances, which gave rise to the Claim, including without limitation the start date of the event or events and the actual or anticipated finish date;

8.2.2.2 detailed identification of the Work (e.g., activity codes from the Construction Progress Schedule) affected by the event giving rise to the Claim;

8.2.2.3 copies of the Contractor's daily log (**Section 6.2.17**) for each day of impact;

8.2.2.4 copies of relevant correspondence and other information regarding or supporting Contractor entitlement;

8.2.2.5 copies of the Contractor's most recent income statement, including segregated general and administrative expenses for the most recent reporting period, and for the period of the Contract, if available, and similar information for any Subcontractor claim included; and

8.2.2.6 the notarized certification described under **Section 8.5.1.1**.

8.2.3 The Contractor's failure to comply with the requirements of this **Section 8.2** shall constitute an irrevocable waiver of any related Claim.

8.3 Substantiation of Claims for Increase of the Contract Sum

8.3.1 The Contractor shall substantiate each Claim for an increase of the Contract Sum with:

8.3.1.1 written documentation as described under **Section 7.7** of the actual additional direct and indirect costs to the Contractor due to the event giving rise to the Claim;

8.3.1.2 a written statement from the Contractor that the increase requested is the entire increase in the Contract Sum associated with the Claim; and

8.3.1.3 the general substantiation documentation described under **Section 8.2**.

8.3.2 The Contractor's failure to comply with the requirements of this **Section 8.3** shall constitute an irrevocable waiver of any related Claim.

8.4 Substantiation of Claims for Extension of the Contract Times

8.4.1 The Contractor shall substantiate each Claim for an extension of the Contract Times with:

8.4.1.1 written documentation as described under **Section 7.8** of the actual delay to the critical path of the Construction Progress Schedule due to the event giving rise to the Claim;

8.4.1.2 a detailed written Proposal as described under **Section 7.7** for an increase in the Contract Sum that would fully compensate the Contractor for all costs of acceleration of the Work needed to completely overcome the associated delay together with a statement consistent with **Section 8.3.1.2**;

8.4.1.3 a written statement from the Contractor that the extension requested is the entire extension of the Contract Times associated with the Claim; and

8.4.1.4 the general substantiating documentation described under **Section 8.2**.

8.4.2 In addition to the requirements of **Section 8.4.1**, if adverse weather conditions are the basis for a Claim for additional time, the Contractor shall document the Claim with data substantiating that weather conditions were abnormal for the period, could not have been reasonably anticipated, and had an adverse effect on a critical element of the scheduled construction. The support for and evaluation of all adverse weather Claims shall be based upon average weather conditions during the 5 years immediately preceding the dates at issue in the Claim as those weather conditions were recorded at the government-controlled weather-recording facility nearest to the Site.

8.4.3 The Contractor's failure to comply with the requirements of this **Section 8.4** shall constitute an irrevocable waiver of any related Claim.

8.5 Certification of the Claim

8.5.1 The Contractor shall certify each Claim within 30 days after initiating the Claim under **Section 8.1** or before Contract Completion, whichever is earlier, by providing the notarized certification specified in **Section 8.5.1.1**, signed and dated by the Contractor:

8.5.1.1 "The undersigned Contractor certifies that the Claim is made in good faith; that the supporting data is accurate and complete to the best of the Contractor's knowledge and belief; that the amount requested is a fair, reasonable, and necessary adjustment for which the Contractor believes the State is liable; and that the undersigned is duly authorized to certify the Claim on behalf of the Contractor."

8.5.2 The date that the Contractor's certified and fully substantiated Claim is received by the Contracting Authority, or the date that the Contractor is required to certify and fully substantiate a Claim pursuant to **Sections 8.2.1** and **8.5.1**, shall trigger the 120-day period for exhaustion of administrative remedies pursuant to ORC Section 153.16(B).

8.5.3 The Contractor's failure to comply with the requirements of this **Section 8.5** shall constitute an irrevocable waiver of any related Claim.

8.6 Delay and Delay Damage Limitations; Derivative Claims

8.6.1 Subject to other provisions of the Contract, the Contractor will be entitled to an extension of the Contract Times on account of delay in the commencement or progress of Work on the critical path of the Construction Progress Schedule caused by acts of Nature or the public enemy, acts of the government not arising from the Contractor's failure to comply with Applicable Law, fires, floods, epidemics, weather, and labor disputes beyond the Contractor's control.

8.6.2 Notwithstanding any other provision of the Contract Documents to the contrary, the Contractor shall not be entitled to an increase in the Contract Sum, or an extension of the Contract Times, or both:

8.6.2.1 on account of the impact of any normal adverse weather on any of the Work or on account of the impact of any abnormal adverse weather on Work not on the critical path;

8.6.2.2 to the extent that a delay occurs concurrently with a delay attributable to the Contractor; or

8.6.2.3 on account of the delay of any Work not on the critical path.

8.6.3 Notwithstanding any other provision of the Contract Documents to the contrary, the Contractor shall not be entitled to an increase in the Contract Sum or any type of damages on account of a delay in the commencement or progress of Work on the critical path unless **(1)** the delay is caused by the Owner and **(2)** the delay was not authorized or permitted under the Contract.

8.6.4 Notwithstanding any other provision of the Contract Documents to the contrary, the Contractor shall not be entitled to an increase in the Contract Sum or any type of damages arising from a delay in the commencement or progress of any of the Work caused by the occurrence or non-occurrence of an event beyond the Owner's control such as acts of Nature or the public enemy, acts of the government, fires, floods, epidemics, labor disputes, unusual delivery delays, weather, or damages caused by the Contractor.

8.6.5 Derivative Claims. Notwithstanding any other provision of the Contract to the contrary, if the Owner prosecutes a claim, suit, or appeal against a Separate Consultant or Separate Contractor to recover damages the Contractor suffers on account of the acts or neglects of a Separate Consultant or Separate Contractor or a person or entity for whom either is legally responsible, the Owner's liability to the Contractor shall not exceed the amount the Owner actually recovers from the Separate Consultant or Separate Contractor on account of those damages less the costs the Owner incurs recovering them. The Owner is not obligated to prosecute any such claim, suit, or appeal.

8.7 Liquidated Damages

8.7.1 If the Contractor fails to achieve a Milestone within the associated Contract Time, it would be difficult, if not impossible, to determine the Owner's resulting damages. Therefore, if the Contractor fails to achieve a Milestone within the associated Contract Time, the Contractor shall (at the Owner's option) pay to or credit the Owner the Liquidated Damages per day sum determined according to the following schedule for each day that the Contractor fails to achieve a Milestone within the associated Contract Time.

Contract Sum	Liquidated Damages per day
Less than $1,000,000	$500
From $1,000,000.01 to $2,000,000	$1,000
From $2,000,000.01 to $5,000,000	$2,000
From $5,000,000.01 to $10,000,000	$5,000
From $10,000,000.01 to $20,000,000	$7,500
From $20,000,000.01 to $50,000,000	$10,000
More than $50,000,000	$15,000

8.7.2 If the Contractor simultaneously fails to achieve two or more Milestones, the Owner shall be entitled to recover the sum of the associated Liquidated Damages per day rates.

8.7.3 The Liquidated Damages described in this **Section 8.7** are only intended to compensate the Owner for the direct damages it incurs as a result of the Contractor's failure to achieve the Milestones within their associated Contract Times.

8.7.4 The Liquidated Damages described in this **Section 8.7** are not intended to compensate the Owner for any damages the Owner incurs on account of **(1)** any claims attributable to the Contractor that are brought by others including Separate Consultants and Separate Contractors or **(2)** any failure of the Contractor to timely, properly, and completely perform the Contract other than the failure to achieve the Milestones within their associated Contract Times.

8.7.5 The parties acknowledge that the above-listed Liquidated Damages per day sums are not penalties, and they each irrevocably waive the right (if any) to challenge the validity and enforceability of those Liquidated Damages per day sums. Notwithstanding any other provision of the Contract Documents to the contrary, if a court determines that the Liquidated Damages per day sums or their application are void and unenforceable, the Owner shall be entitled to recover the actual damages that it incurs on account of the Contractor's failure to achieve one or more of the Milestones within the Contract Times.

8.7.6 In addition to other rights that the Owner may have relative to the Liquidated Damages, the Contracting Authority may deduct the Liquidated Damages from the Contract Sum as the damages accrue. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall immediately pay the amount of the insufficiency to the Owner.

8.8 Mutual Waiver of Consequential Damages

8.8.1 Except as provided under **Section 8.8.2**, the Owner and Contractor each waive against the other all Claims for consequential damages that may arise out of or relate to this Contract.

8.8.1.1 The Owner's waiver includes Claims for loss of use, income, profit, revenue, financing, cost of capital, business and reputation, management and employee productivity, and consequential damages arising from termination of the Contract or related to insolvency.

8.8.1.2 The Contractor's waiver includes Claims for unabsorbed home-office overhead; any other form of overhead in excess of that specifically provided for under **Section 7.7**; delay damages except as otherwise specifically provided for in **Section 8.6**; increased cost of funds for the Project; lost opportunity to work on other projects; losses of financing, business, and reputation; loss of profit except anticipated profit arising directly from properly performed Work; loss of bonding capacity; and consequential damages arising from termination of the Contract or related to insolvency.

8.8.2 Notwithstanding **Section 8.8.1**, this **Section 8.8**:

8.8.2.1 does not apply to any damages that would be covered by insurance provided in connection with the Project if the Contract did not include **Section 8.8.1;**

8.8.2.2 does not apply to the Contractor's indemnity obligations for third-party claims against the Indemnified Parties even if those claims are for damages that **Section 8.8.1** would otherwise preclude;

8.8.2.3 does not preclude the Owner's recovery of Liquidated Damages under **Section 8.7**; and

8.8.2.4 does not apply to Claims for damages arising from the Owner's or the Contractor's gross negligence or willful misconduct.

8.8.3 This **Section 8.8** shall survive termination of the Contract.

8.9 Review of the Claim

8.9.1 The A/E shall review the Claim and prepare a written analysis of its content, which shall include:

8.9.1.1 a narrative of the A/E's examination of the facts giving rise to the Claim;

8.9.1.2 identification of relevant Contract Documents and language;

8.9.1.3 an analysis of whether the Contractor complied with the requirements of the Contract Documents pertaining to Claim initiation and substantiation including, without limitation, the issues of entitlement to, and calculation of, adjustments of the Contract Sum, Contract Times, or both;

8.9.1.4 an analysis of claimed additional labor, materials, and equipment for the scope of the Work items described;

8.9.1.5 an analysis of any time extension for any interference, disruption, hindrance, impact, or delay claimed (to include the calculation of any concurrent delays affecting entitlement);

8.9.1.6 a concluding opinion regarding Contractor entitlement to, and the appropriateness and reasonableness of all, or any part of, the Claim; and

8.9.1.7 an appendix containing copies of contemporaneous documentation supporting the concluding opinion.

8.9.2 The A/E shall submit the written analysis to the Project Manager no more than 30 days after receiving the Contractor's substantiated and certified Claim.

8.10 Claim Decision

8.10.1 The Project Manager shall examine the Contractor's Claim and A/E's analysis.

8.10.2 The Project Manager shall approve or deny all, or any part, of the Contractor's Claim and forward a written decision to the Contractor, A/E, Owner, and Contracting Authority within 14 days after receiving the A/E's analysis.

8.10.2.1 The Project Manager may employ independent resources to assist in its review, or refer evaluation of the Claim to a consultant.

8.10.3 If the Contractor and Owner agree with the Project Manager's decision, the decision shall be incorporated into a Change Order.

8.10.4 Any Claim remaining unresolved after completion of the process described under this **Section 8.10** shall be subject to Claim decision review as described under **Section 8.11**.

8.11 Claim Decision Review

8.11.1 The Contractor may request review of the Project Manager's decision by written notice delivered by certified mail within 14 days of the Project Manager's decision.

8.11.1.1 If the Project is administered by the Commission, jointly administered by the Commission and a public school district, or locally administered by authority granted to an agency of the state of Ohio by the Commission, the written notice shall be delivered to the Executive Director of the Commission.

8.11.1.2 If the Project is locally administered by an Institution of Higher Education under ORC Section 3345.50 or ORC Section 3345.51, the written notice shall be delivered to the Institutional Designee who will review the Project Manager's decision instead of the Commission.

8.11.2 The Commission or Institutional Designee, if applicable, shall schedule and conduct a meeting within 30 days after receiving the Contractor's request for review.

8.11.2.1 The Commission or Institutional Designee may employ independent resources to assist in the meeting and review.

8.11.3 The Commission or Institutional Designee, if applicable, shall determine the final disposition of the Contractor's request for review and provide a written decision to the Contractor and Owner within 14 days after the meeting.

8.11.4 The decision of the Commission or Institutional Designee is the final administrative decision of the Contracting Authority as described under ORC Section 153.12(B).

8.11.5 If the Contractor and Owner agree with the Commission's or the Institutional Designee's decision, the decision shall be incorporated into a Change Order.

8.11.6 Any Claim remaining unresolved after completion of the process described under this **Section 8.11** shall be subject to litigation, which may be preceded by Alternative Dispute Resolution ("ADR") as described under **Section 8.13**.

8.12 Delegation

8.12.1 No provision of this **Article 8** shall prevent the Executive Director from delegating the duties or authorities of the Commission to any other person selected at the Executive Director's sole discretion.

8.13 Alternative Dispute Resolution

8.13.1 The intent of the ADR process is to resolve disputes quickly and equitably in a manner agreed upon by all parties to the dispute.

8.13.2 The ADR procedure shall be accepted by all of the Project's key stakeholders.

8.13.3 The accepted ADR methods shall not include binding arbitration; alter any of the requirements for Claim initiation, certification, and substantiation; or alter the administrative process described under this **Article 8**.

8.13.4 The following forms of non-binding ADR may be considered:

8.13.4.1 Negotiation: If negotiation is warranted, the parties to the dispute may agree to a progressive level of negotiators, invested with the authority to agree to a determination of an adjustment in the Contract Sum, Contract Times, or both.

8.13.4.2 Dispute Review Board: If a dispute review board is the accepted ADR procedure, or the process to follow when negotiations are unsuccessful, the parties to the dispute shall jointly select 3 neutral third parties to monitor the progress of construction and provide recommended resolutions to disputes that are brought before them. The costs of the dispute review board shall be shared equally among the parties to the dispute.

8.13.4.3 Mediation: If mediation is the accepted ADR procedure, or the process to follow when negotiations are unsuccessful, the parties to the dispute shall accept a neutral third party to mediate the dispute. The costs of mediation shall be shared equally among the parties to the dispute.

8.13.4.4 Another ADR procedure accepted by all of the Project's key stakeholders.

8.14 Audit of the Claim

8.14.1 All Claims shall be subject to audit at any time following filing of the Claim, whether or not the Claim is part of a lawsuit.

8.14.2 The audit may be performed by employees of the Contracting Authority or by a consultant engaged by the Contracting Authority.

8.14.3 The audit may begin upon 10-days' notice to the affected Contractor or affected Subcontractor.

8.14.4 The Contractor shall cooperate with the request.

8.14.5 Failure of the Contractor or Subcontractor to produce sufficient records to allow the Contracting Authority to audit and verify a Claim shall constitute an irrevocable waiver of the Claim or portion of the Claim that could not be completely audited.

8.14.6 The Contractor shall make available to the Contracting Authority all Contractor and Subcontractor documents related to the Claim including, without limitation, the following documents:

8.14.6.1 daily time sheets and superintendent's daily reports;

8.14.6.2 union agreements, if any, and employer agreements;

8.14.6.3 insurance, welfare, fringes, and benefits records;

8.14.6.4 payroll register;

8.14.6.5 earnings records;

8.14.6.6 payroll tax returns;

8.14.6.7 material invoices, purchase orders, Subcontracts, and all material and supply acquisition contracts;

8.14.6.8 material cost distribution worksheets;

8.14.6.9 equipment records (list of Contractor equipment, rates, etc.);

8.14.6.10 vendor rental agreements and Subcontractor invoices;

8.14.6.11 Subcontractor payment certificates;

8.14.6.12 canceled checks (payroll and vendors);

8.14.6.13 job cost report;

8.14.6.14 job payroll ledger;

8.14.6.15 general ledger, general journal, (if used) and all subsidiary ledgers and journals together with all supporting documentation pertinent to entries made in these ledgers and journals;

8.14.6.16 cash disbursements journal;

8.14.6.17 financial statements for all years reflecting operations on the Project;

8.14.6.18 income tax returns for all years reflecting operations on the Project;

8.14.6.19 depreciation records on all equipment utilized whether the records are maintained by the Contractor, its accountant, or others;

8.14.6.20 if a source other than depreciation records is used to develop costs for the Contractor's internal purposes in establishing the actual cost of owning and operating equipment, all other source documents;

8.14.6.21 all documents that reflect the Contractor's actual profit and overhead during the years the Project was being performed;

8.14.6.22 all documents related to the preparation of the Contractor's Bid, including the final calculations on which the Bid was based, unless the documents are placed in escrow under provisions of the Instructions to Bidders;

8.14.6.23 all documents that relate to the Claim together with all documents that support the amount of damages as to the Claim;

8.14.6.24 worksheets used to prepare the Claim establishing the cost components for items of the Claim including, but not limited to, labor, fringes, benefits and insurance, materials, equipment, Subcontractors, and all documents that establish the periods of time, individuals involved, the hours and rate of pay for the individuals; and

8.14.6.25 all other documents required by the Contracting Authority to reasonably review the Claim.

8.15 False Certification of the Claim

8.15.1 If the Contractor falsely certifies all or any part of a Claim, the portion of the Claim falsely certified shall be denied, and may be sufficient cause for the State to debar the Contractor from future State contracting opportunities as permitted by law.

8.16 Performance and Payment

8.16.1 The Contractor shall proceed with the Work during any dispute resolution process, unless otherwise agreed by the Contractor and Contracting Authority in writing.

8.16.2 The Contracting Authority shall continue to make payment of any undisputed amounts in accordance with the Contract Documents pending final resolution of a Claim, unless otherwise agreed by the Contractor and Contracting Authority in writing.

ARTICLE 9 - COMPENSATION AND PAYMENT

9.1 Allowances

9.1.1 The Contract Sum includes the Allowances (if any) identified in the Contract.

9.1.2 All Allowances include the cost to the Contractor (less any applicable trade discounts) of materials and equipment required by the Allowances to be delivered at the Site, and all applicable taxes.

9.1.3 The Contractor's Fee and costs for unloading and handling on the Site, labor, installation costs, and other expenses contemplated for the Allowances are not in the stated Allowance amounts but are otherwise included in the Contract Sum.

9.1.4 Before final payment, an appropriate Change Order will be issued to reconcile the Contract Sum so that it reflects actual amounts due to the Contractor on account of Work covered by Allowances.

9.2 Unit Prices

9.2.1 Where the Contract provides that all or part of the Work is to be Unit Price Work, initially the Contract Sum will include for all Unit Price Work **(1)** an amount equal to the sum of the established Unit Prices for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Contract plus **(2)** the Contractor's Fee on that Unit Price Work.

9.2.2 The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Sum. The Contracting Authority will determine the actual quantities and classifications of Unit Price Work performed by Contractor.

9.2.3 The Contractor's Fee on account of Unit Price Work is not in the stated Unit Price amounts but are otherwise included in the Contract Sum.

9.2.4 Before final payment, an appropriate Change Order will be issued as described under **Section 7.1.5** to reconcile the Contract Sum so that it reflects actual amounts due to the Contractor on account of Unit Price Work actually performed.

9.3 Schedule of Values

9.3.1 Within 10 days after receipt of the Notice to Proceed, or other period as mutually agreed by the Contractor and Contracting Authority, the Contractor shall submit to the A/E a Schedule of Values on a form published by the Commission, with separate amounts shown for labor and materials for each branch of Work, following the numbers and titles of the Construction Specifications Institute's *MasterFormat* for individual work results, or *UniFormat* for assemblies in place.

9.3.1.1 The Contractor shall clearly indicate on the Schedule of Values, the amount(s) allocated, including separate items for Contractor's Fee (overhead and profit), for each EDGE-certified Business used in the performance of the Work. The amount(s) shall indicate labor and materials, as appropriate.

9.3.2 The grand total shown on the Schedule of Values shall equal the total Contract Sum. The Contracting Authority may use the approved Schedule of Values to determine the cost or credit to the Owner resulting from any change in the Work.

9.3.2.1 The first items shall be a breakdown of General Conditions Costs.

9.3.2.2 The amounts for labor and materials shall accurately reflect the cost for each item. Separate items shall not be shown for Contractor's Fee, except when Work is performed or materials are supplied by an EDGE-certified Business, pursuant to **Section 9.3.1.1**. Contractor's Fee shall be included in the totals for labor and materials.

9.3.2.3 If the material allocation exceeds 55 percent of the Contract Sum, the Contractor shall provide, upon request, sufficient information to support the higher percentage.

9.3.2.4 Subcontract Work shall show amounts for labor and materials. Fringe benefits shall be shown as a part of labor costs.

9.3.2.5 When more than one major structure is included in the Work, the Contractor shall subdivide the Schedule of Values accordingly, with cost details for each structure shown separately.

9.3.2.6 The line items shall be coordinated with line items in the Project Schedule, which may require division of items of Work by area of the Project by floor, phase, or other appropriate area.

9.3.2.7 Mechanical and electrical Work shall be included in separate line items for all major pieces of equipment, and group smaller equipment items by type.

9.3.2.8 Line items shall be included for each Allowance, Punch List Work, Project Record Document Submittals, delivery of attic stock, and specified demonstrations and training.

9.3.3 The A/E may return the Schedule of Values to the Contractor for re-submittal if it does not meet the requirements or contains insufficient items or details of the Work, or approve the Schedule of Values if the A/E determines that it conforms to this **Section 9.3**.

9.3.4 No payment shall be made until the A/E has approved the Contractor's Schedule of Values.

9.4 Contractor Payment Request

9.4.1 The Contractor may submit a Contractor Payment Request for Work performed based upon the Schedule of Values to the A/E each month or upon another interval approved by the Contracting Authority. When the rate of Work and amount involved is sufficient that it is considered appropriate by the Contracting Authority, the Contractor may submit Contractor Payment Requests twice a month.

9.4.1.1 The Contractor shall support each Contractor Payment Request with documentation substantiating the Contractor's right to payment. The Contractor shall supply additional documentation as the A/E may request in connection with each payment to the Contractor.

9.4.1.2 The Contracting Authority may require proof of the renewal of required insurance as a condition precedent to payment.

9.4.1.3 The Contractor shall attach certified payroll reports for the relevant period to 1 copy of each Contractor Payment Request, see **Document 00 73 43 - Prevailing Wage Requirements**.

9.4.1.4 The Contractor may list on the Contractor Payment Request any Change Orders approved and performed prior to submission of the Contractor Payment Request.

9.4.1.5 The Contractor shall submit its Contractor Payment Request using the Contractor Payment Request form or forms current at the time of each application and as provided by the Contracting Authority in the manner prescribed by the Contracting Authority.

9.4.1.6 The Contractor shall submit 1 draft copy of its Contractor Payment Request ("Pencil Copy") to the A/E not less than 1 week prior to submitting multiple copies of its Contractor Payment Request. The A/E shall review the Pencil Copy and provide comments to the Contractor within 3 days of receiving it. The Contractor shall incorporate the A/E's comments into its Contractor Payment Request prior to submitting multiple copies for payment.

9.4.1.7 The Contractor shall clearly indicate on the Contractor Payment Request, the amount(s) requested for each EDGE-certified Business used in the performance of the Contract. The amount(s) shall indicate labor and materials, as appropriate.

9.4.1.8 The Contractor shall submit an electronic copy of the Contractor Payment Request to the A/E with its paper copies of the Contractor Payment Request for collection and reporting of information used for contract compliance evaluation and statistical purposes. The Contractor may issue the copy in any electronic media acceptable to the Contracting Authority.

9.4.2 Payments, except for lump sum items, in Unit Price Contracts shall be made to the Contractor only for the authorized actual quantities of Work performed or materials furnished in accordance with the Contract Documents.

9.4.3 Subject to **Section 9.8**, the Owner shall pay an approved Contractor Payment Request within 30 days from the date the A/E recommends acceptance of the Contractor Payment Request.

9.4.3.1 Payments due and not paid to the Contractor, through no fault of the Contractor, within the 30 day period shall, from the date payment is due, bear simple interest at the applicable statutory rate.

9.4.4 Notwithstanding any other provision of the Contract Documents, partial payments made pursuant to this **Section 9.4** constitutes neither acceptance of any Defective Work, nor a waiver of any rights set forth in the Contract Documents or otherwise provided by Applicable Law.

9.4.5 The Contracting Authority and Owner may audit Contractor Payment Requests as described under **Section 7.9**.

9.5 Labor Payments

9.5.1 Partial payments to the Contractor for labor performed under either a Unit Price or lump sum Contract shall be made at the rate of 92 percent of the amount invoiced through the Contractor Payment Request that shows the Work is 50 percent complete.

9.5.2 After the Work is 50 percent complete, as evidenced by payments of at least 50 percent of the Contract Sum including approved Change Orders to date, no additional funds shall be retained from payments for labor.

9.6 Material Payments

9.6.1 The Owner shall pay the Contractor at the rate of 100 percent of the scheduled value for materials incorporated into the Project.

9.6.2 The Owner shall pay the Contractor at the rate of 92 percent of the invoice cost, not to exceed the scheduled value in a Unit Price or lump sum Contract, for materials delivered to the Site, or other off-site storage location approved by the A/E, provided the Contractor provides the following information with the Contractor Payment Request:

9.6.2.1 a list of the fabricated materials consigned to the Project, giving the place of storage, together with copies of invoices, in order to verify quantity and cost; and

9.6.2.2 a certification of materials stored off-site, prepared by the Contractor and signed by the A/E to evidence that the materials are in conformity with the Specifications and have been tagged with the Project name and number for

delivery to the Project. The Contractor shall directly reimburse the A/E for all costs incurred to visit a storage site, other than the areas adjacent to the Project.

9.6.2.3 The Owner shall pay the balance of the scheduled value when the materials are incorporated into and become a part of the Project.

9.6.3 When payment is allowed for materials delivered to the Site or other approved off-site storage location but not yet incorporated into the Project, the materials are the property of the Owner.

9.6.3.1 The Owner may, at its sole discretion, retain any material not ultimately incorporated into the Project or return it to the Contractor for credit of an amount proportionate to the value of the extra materials.

9.7 Retainage

9.7.1 If the total Contract Sum is $15,000 or more, when the Contract is 50 percent complete, all funds retained for faithful performance of the Work, in accordance with **Section 9.5.1**, shall be deposited in an escrow account with a bank in the state in accordance with the terms and conditions provided in an escrow agreement executed by the Contractor, Contracting Authority, and applicable bank.

9.7.2 When the Contractor has achieved Substantial Completion of all Work, and there is no other reason to retain funds; upon request of the Contractor, the funds retained in connection with that Work shall be released from escrow and paid to the Contractor, withholding only that amount necessary to assure faithful completion in the sole discretion of the Contracting Authority, including but not limited to compliance with **Section 6.25.2**.

9.7.3 Upon consent by the Contractor's Surety, the Contracting Authority may reduce the amount of funds retained for the faithful performance of Work by 50 percent of the amount of funds required to be retained, provided the Contractor's Surety remains responsible for all damages that may be caused due to default by the Contractor, including, but not limited to, the following:

9.7.3.1 completion of the Work;

9.7.3.2 all interference, disruption, hindrance and delay claims;

9.7.3.3 all Liquidated Damages; and

9.7.3.4 all additional expenses incurred by the State.

9.8 Payments Withheld

9.8.1 The A/E may recommend to the Contracting Authority that payments be withheld from, or Liquidated Damages be assessed against, a Contractor Payment Request.

9.8.2 The Contracting Authority may decline to approve any Contractor Payment Request or part thereof, or nullify any previous Contractor Payment Request, in whole or in part, to the extent necessary in the Contracting Authority's sole opinion to protect the Owner from loss because of:

9.8.2.1 Defective Work not remedied;

9.8.2.2 damage caused by the Contractor;

9.8.2.3 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

9.8.2.4 reasonable evidence that the Work will not be completed within the Contract Times, and that the unpaid balance would not be adequate to cover damages under the Contract Documents for the anticipated delay;

9.8.2.5 failure to comply with Applicable Law including, but not limited to, the requirements of ORC Chapter 4115;

9.8.2.6 failure to timely submit EDGE Participation Reports in accordance with **Section 1.8.2**;

9.8.2.7 failure to timely identify the Contractor's proposed Subcontractors in accordance with **Section 4.1.1**;

9.8.2.8 failure to timely approve a Construction Progress Schedule in accordance with **Section 6.5**;

9.8.2.9 failure to carry out the Work in accordance with the Contract Documents; or

9.8.2.10 that which is permitted under other provisions of the Contract Documents.

9.8.3 If the Contractor remedies the basis for withholding payment under **Section 9.8.2** to the Contracting Authority's satisfaction, the Owner shall pay the amounts withheld.

9.9 Final Contractor Payment Request

9.9.1 The Contractor, as a condition precedent to execution of the Certificate of Contract Completion and to final payment, shall complete all requirements of the Contract Documents.

9.9.1.1 The Contractor and each of its Subcontractors, regardless of tier, shall execute a Payment Release Affidavit to certify that the Contractor and each of its Subcontractors, regardless of tier, have complied with all requirements of ORC Chapter 4115, and to certify that all of its Subcontractors have been paid in full for all Work performed or materials furnished for the Project.

9.9.2 The Owner shall pay the final Contractor Payment Request within 30 days from the date the A/E recommends acceptance of the final Contractor Payment Request.

9.9.2.1 Payments due and not paid to the Contractor within the 30 day period shall bear interest from the date payment is due under the Contract Documents at the applicable statutory rate.

9.9.3 Acceptance of final payment by the Contractor or a Subcontractor constitutes the payee's waiver of all claims against the State except those previously made in writing under **Article 8** and identified by that payee as unsettled at the time of the final Contractor Payment Request.

ARTICLE 10 - BONDS, INSURANCE, AND INDEMNIFICATION

10.1 Payment and Performance Bonds

10.1.1 Before signing the Agreement, the Contractor shall provide the Bond required under Applicable Law and below:

10.1.1.1 If the Contractor provided **Document 00 43 13 - Bid Security Form** as its Bid Guaranty, then that form shall be the Bond.

10.1.1.2 If the Contractor provided another form of Bid Guaranty, then **Document 00 61 13 - Performance and Payment Bond Form** shall be the Bond.

10.1.1.3 Each Surety under the Bond shall be licensed to do business in Ohio and satisfactory to the Contracting Authority.

10.1.1.4 If there is more than one Surety under the Bond, each of them shall be jointly and severally liable as surety under the Bond.

10.1.1.5 Unless the Contracting Authority and the Owner are the same entity, the Bond shall name the obligee as follows: **(1)** the State by and through the Contracting Authority and **(2)** the Owner.

10.1.1.6 The penal sum of the Bond, when initially submitted, shall be equal to one-hundred percent of the Contract Sum.

10.1.2 The Contractor shall submit with the executed Bond **(1)** a certified copy of the authority to act (power of attorney) of the agent signing the Bond on behalf of the Surety and **(2)** a current and signed Certificate of Compliance under ORC Section 9.311 issued by the Ohio Department of Insurance showing the Surety is licensed to do business in Ohio.

10.1.3 If the Contract Sum increases at any time such that it exceeds the penal sum of the Bond, the Contractor shall cause the penal sum of the Bond to be increased such that the penal sum equals one-hundred percent of the increased Contract Sum.

10.1.4 Any time the Contractor increases the penal sum of the Bond under **Section 10.1.3**, the Contractor shall deliver to the Contracting Authority written consent of the affected Surety or Sureties confirming the increased penal sum. The Contracting Authority's receipt of that written consent is a condition precedent to the Owner's obligation to pay the Contractor for any portion of the Work associated with the increase.

10.1.5 If notice of any change affecting the Contract is required by any Surety or by the provision of any Bond, the Contractor shall provide that notice.

10.2 Contractor's General Insurance Requirements

10.2.1 Throughout the performance of the Work or longer as may be described below, the Contractor shall obtain, pay for, and keep in force, the minimum insurance coverage described in this **Article 10**.

10.2.1.1 Each requirement of this **Article 10** applies to Subcontractors just as it applies to the Contractor.

10.2.1.2 If a Subcontractor's usual insurance coverage does not meet the minimum coverage requirements, before entering into an agreement with that Subcontractor, the Contractor shall submit to the Contracting Authority **(1)** a

certificate of insurance evidencing the insurance the Subcontractor will carry without additional compensation and **(2)** if the Contracting Authority requests, a written proposal from the Subcontractor to provide coverage that meets the minimum coverage requirements. The Contracting Authority will decide whether to accept the non-conforming insurance coverage or the proposal to provide conforming coverage.

10.2.1.3 On a case-by-case basis, the Contracting Authority and Contractor may agree to adjust the below requirements for any particular Subcontractor.

10.2.2 Before starting the Work on the Site, upon renewal of any policy, and upon a change of any insurance carrier, the Contractor shall deliver to the Contracting Authority certificates evidencing that the required insurance is in force.

10.2.3 With the exception of government-controlled workers compensation coverage:

10.2.3.1 the Contractor shall place the insurance with companies that **(1)** are satisfactory to the Contracting Authority, **(2)** hold an A.M. Best Rating of A-, X, or higher, and **(3)** are authorized to conduct business in Ohio;

10.2.3.2 the policies shall be endorsed to require the Contractor's insurance carrier to **(1)** provide 30-days' written notice to the Contracting Authority (as certificate holder) of the cancellation or non-renewal of the insurance and **(2)** provide at least 10-days' written notice to the Contracting Authority (as certificate holder) of the cancellation of the insurance for non-payment of premium; and

10.2.3.3 within 30 days of the Contracting Authority's request, the Contractor shall submit insurance-company certified copies of the policies, the policy endorsements, loss-run reports, or all three.

10.2.4 The Contractor shall pay all deductibles, or self-insured retentions, or both contained in the Contractor's policies of insurance required or provided in connection with the Project. The Contracting Authority reserves the right to approve or reject all levels of self-insured retention, captive insurance programs, or other alternative risk financing the Contractor may use to comply with any insurance requirement.

10.2.5 The Contractor shall pay a proportionate share of the deductibles, or self-insured retentions, or both contained in any insurance policy the Contracting Authority purchases for the Project. The Contractor's proportionate share will derive from the percentage of the associated claim or loss attributable to the alleged or actual negligence of the Contractor or a Subcontractor.

10.2.6 The Contracting Authority and Owner do not represent that required coverage or limits are adequate to protect the Contractor.

10.2.7 Failure of the Contracting Authority to demand a certificate or other evidence of full compliance with the insurance requirements or failure of Contracting Authority to identify a deficiency from evidence that is provided shall not be construed as a waiver of the Contractor's obligation to maintain the required insurance.

10.2.8 The Contracting Authority may terminate the Contract for cause on account of the Contractor's failure to maintain required insurance.

10.3 Contractor's Minimum Coverage Requirements

10.3.1 Workers Compensation. The Contractor shall maintain workers compensation coverage meeting the requirements of Applicable Law.

10.3.2 Employers Liability Coverage. The Contractor shall maintain employers liability coverage with **(1)** an each-accident limit of not less than $1,000,000, **(2)** a disease each-employee limit of not less than $1,000,000, and **(3)** a disease policy limit of not less than $1,000,000.

10.3.3 Commercial General Liability. The Contractor shall maintain commercial general liability ("CGL") coverage that provides **(1)** an each-occurrence limit of not less than $1,000,000, **(2)** a general-aggregate limit of not less than $2,000,000, and **(3)** a products and completed-operations aggregate limit of not less than $2,000,000.

10.3.3.1 The CGL insurance shall be written on ISO occurrence form CG 00 01 10 01 or a substitute form, providing at least equivalent coverage for liability arising from premises, operations, independent contractors, products/completed-operations, personal and advertising injury, and liability assumed under an insured contract.

10.3.3.2 The Contractor shall include the State, Contracting Authority, Owner, and A/E as additional insureds under the CGL policy using ISO endorsement CG 20 10 07 04 and ISO endorsement CG 20 37 07 04 or a substitute form(s) providing equivalent coverage.

10.3.3.3 The CGL policy shall be endorsed using ISO endorsement CG 25 03 or a substitute form providing equivalent coverage to provide that the general aggregate limit applies separately to each of the insured's projects.

10.3.3.4 The CGL insurance shall apply as primary and non-contributory insurance with respect to any other insurance or self-insurance programs that cover the additional insured(s).

10.3.3.5 The CGL policy shall not exclude coverage to the additional insured(s) for bodily injury or property damage arising out of the products/completed-operations hazard.

10.3.3.6 The Contractor shall maintain the CGL insurance in effect for no less than 5 years after the earlier of the termination the Contract or Substantial Completion of all Work.

10.3.4 Business Automobile Liability. The Contractor shall maintain business automobile ("BA") coverage written on ISO form CA 00 01 10 01 or a substitute form, providing at least equivalent coverage with a limit of not less than $1,000,000 each accident.

10.3.4.1 The coverage shall extend to any auto.

10.3.4.2 The Contractor shall include the State, Contracting Authority, Owner, and A/E as additional insureds under the BA policy.

10.3.5 Umbrella/Excess Liability. The Contractor may employ an umbrella/excess liability policy to achieve the above-required minimum coverage.

10.3.5.1 The Contractor shall maintain umbrella/excess liability coverage with a limit of not less than $2,000,000 (in addition to the above-required limits) if the Work (or the Work to be performed by the Subcontractor) includes any of the following:

.1 brick/block masonry;
.2 exterior caulking/sealant;
.3 cast-in-place or precast concrete;
.4 curtain wall;
.5 dampproofing/waterproofing;
.6 electrical;
.7 elevator;
.8 exterior glass and/or glazing;
.9 exterior marble, granite, and/or other stonework;
.10 miscellaneous metals;
.11 plaster/stucco;
.12 plumbing;
.13 HVAC;
.14 roofing and/or sheet metal;
.15 scaffolding;
.16 spray-on fireproofing;
.17 sprinkler and/or fire protection; or
.18 structural steel and/or metal deck.

10.3.5.2 The Contractor shall maintain umbrella/excess liability coverage with a limit of not less than $5,000,000 (in addition to the above-required limits) if the Work (or the Work to performed by the Subcontractor) includes any of the following:

.1 caissons and/or piles;
.2 demolition;
.3 excavation and/or utility work;
.4 sheeting, shoring, and/or underpinning;
.5 window washing equipment; or
.6 wrecking.

10.3.6 Contractor's Pollution Liability. If the Work includes environmentally sensitive, hazardous types of activities (such as demolition, exterior insulation finish systems, Asbestos abatement, storage-tank removal, or similar activities), or involves Hazardous Materials, the Contractor shall maintain a contractor's pollution liability ("CPL") policy with **(1)** a per-claim limit of not less than $1,000,000 and **(2)** an annual-aggregate limit of not less than $1,000,000, covering the acts, errors and/or omissions of the Contractor for damages (including from mold) sustained by the Owner by reason of the Contractor's performance of the Work.

10.3.6.1 The CPL policy shall have an effective date, which is on or before the date that the Contractor first started to perform any Project-related services.

10.3.6.2 Upon submission of the associated certificate of insurance and at each policy renewal, the Contractor shall advise the Contracting Authority in writing of any actual or alleged claims that may erode the CPL policy's limits.

10.3.6.3 The Contractor shall maintain the CPL insurance in effect for no less than 5 years after the earlier of the termination of the Contract or Substantial Completion of all Work.

10.3.7 Professional Liability—Contractor. The Contractor shall maintain professional liability insurance (including without limitation for sprinkler and/or fire protection and other design-build work included in the Work) without design-build exclusions with limits not less than as identified in the following table:

Contract Sum	Each Claim	Annual Aggregate
Up to $50,000,000	$1,000,000	$2,000,000
More than $50,000,000	$2,000,000	$4,000,000

10.3.7.1 The professional liability policy shall have an effective date on or before the date that the Contractor first started to provide any Project-related services.

10.3.7.2 Upon submission of the associated certificate of insurance and at each policy renewal, the Contractor shall advise the Contracting Authority in writing of any actual or alleged claims that may erode the professional liability policy's limits.

10.3.7.3 The Contractor shall maintain the professional liability insurance in effect for no less than 5 years after the earlier of the termination of the Contract or Substantial Completion of all Work.

10.3.7.4 If the Contractor is not authorized under Applicable Law to directly provide professional design services, the Contractor may satisfy the requirements of this **Section 10.3.7** by providing a contractor's professional liability insurance policy.

10.3.7.5 If the Contractor is a joint venture:

.1 the Contractor may meet the requirements of this **Section 10.3.7** by providing a PL policy under which each joint venturer is the insured; or

.2 each joint venturer shall individually meet the requirements of this **Section 10.3.7** by providing a PL policy **(1)** under which the individual joint venturer is the insured and **(2)** that covers that joint venturer's interests in the joint venture by endorsement or otherwise. The certificate of insurance shall reflect that the PL policy covers the joint venturer's interest in the joint venture.

Example: Assume that the Contractor **(1)** is the "XY joint venture" of company "X" and company "Y"; and **(2)** is required under **Section 10.3.7** to maintain PL insurance limits of $1M/$2M. In order to comply with **Section 10.3.7.5.2**, "X" must maintain PL insurance limits of $1M/$2M and "Y" must maintain PL insurance limits of $1M/$2M.

10.3.7.6 If the Contractor is a limited-liability company, which members consist of two or more separate firms:

.1 the Contractor may meet the requirements of this **Section 10.3.7** by providing a PL policy under which the limited-liability company is the insured; or

.2 each member of the limited-liability company shall individually meet the requirements of this **Section 10.3.7** by providing a PL policy **(1)** under which the individual member is the insured and **(2)** that covers that member's interests in the limited-liability company by endorsement or otherwise. The certificate of insurance shall reflect that the PL policy covers the member's interest in the limited-liability company.

Example: Assume that the Contractor **(1)** is the "XY limited-liability company," the members of which are "X" and "Y"; and **(2)** is required under **Section 10.3.7** to maintain PL insurance limits of $1M/$2M. In order to comply with **Section 10.3.7.6.2**, "X" must maintain PL insurance limits of $1M/$2M and "Y" must maintain PL insurance limits of $1M/$2M.

10.3.8 Professional Liability—Subcontractors. If the Work to be performed by a Subcontractor includes any professional design services (including without limitation sprinkler and/or fire protection and other design-build work) the Subcontractor shall maintain professional liability insurance without design-build exclusions with limits not less than as identified in the following table:

Subcontract Sum	Each Claim	Annual Aggregate
Up to $50,000,000	$1,000,000	$2,000,000
More than $50,000,000	$2,000,000	$4,000,000

10.3.8.1 The professional liability policy shall have an effective date on or before the date that the Subcontractor first started to provide any Project-related services.

10.3.8.2 Upon submission of the associated certificate of insurance and at each policy renewal, the Contractor shall advise the Contracting Authority in writing of any actual or alleged claims that may erode the Subcontractor's professional liability policy's limits.

10.3.8.3 The Subcontractor shall maintain the professional liability insurance in effect for no less than 5 years after the earlier of the termination of the Contract or Substantial Completion of all Work.

10.3.8.4 If the Subcontractor is not authorized under Applicable Law to directly provide professional design services, the Subcontractor may satisfy the requirements of this **Section 10.3.7.5** by providing a contractor's professional liability insurance policy.

10.3.9 Aviation Liability. If the Contractor or a Subcontractor uses aircraft, including helicopters, in performance of the Work, the Contractor shall maintain aircraft or aviation liability coverage in an amount of no less than $10,000,000. The Contracting Authority and Owner will not be liable for any damage to any aircraft owned, leased, rented, or borrowed by the Contractor or a Subcontractor.

10.3.10 Watercraft Liability. If the Contractor or a Subcontractor uses watercraft in performance of the Work, the Contractor shall maintain watercraft liability coverage including protection and indemnity insurance in an amount of no less than $5,000,000. The Contracting Authority and Owner will not be liable for any damage to any watercraft owned, leased, rented, or borrowed by the Contractor or Subcontractor.

10.3.11 Equipment Coverage. The Contracting Authority and Owner will not insure or be liable for damage to any Contractor or Subcontractor owned, leased, rented, or borrowed tools, equipment, or vehicles. The Contractor and Subcontractors are solely responsible for maintaining all insurance necessary to cover their tools, equipment, and vehicles.

10.3.12 Ocean Marine Insurance. If the shipment of equipment or materials for the Work will not be covered by the builder's risk insurance required under **Section 10.4**, the Contractor shall maintain ocean marine insurance to the Site including cost, insurance, and freight with limits of not less than an amount equal to the full replacement cost of equipment/materials shipped to final destination point. The insurance shall include the following minimum requirements:

10.3.12.1 all-risk basis including war risk and all forms of terrorism;

10.3.12.2 coverage for general average and salvage charges;

10.3.12.3 "on deck" coverage;

10.3.12.4 warehouse-to-warehouse coverage;

10.3.12.5 coverage to include losses from strikes, riots, and civil commotions ("SR&CC coverage");

10.3.12.6 coverage to include losses from free of capture and seizure warranty ("FC&S Warranty coverage");

10.3.12.7 "Inchmaree" clause;

10.3.12.8 sue and labor;

10.3.12.9 "both-to-blame" coverage;

10.3.12.10 free of particular average;

10.3.12.11 inland coverage including on-land shipment, port storage, and barge transit upon inland waterways; and

10.3.12.12 damage by saltwater and rainwater perils and cargo sweat.

10.3.13 Additional Property Insurance. For any demolition, blasting, excavating, tunneling, shoring, or similar operations, the Contractor shall provide and maintain Property Damage Liability insurance with a limit of liability equal to the limit as specified in the applicable sections of **Article 10**.

10.4 Builder's Risk Insurance

10.4.1 The Contractor shall provide and maintain, during the progress of the Work and until Contract Completion, a builder's risk insurance policy to cover all Work in the course of construction including false-work, temporary buildings and structures, and materials used in the construction process, stored on or off-site, or while in transit. This insurance shall be on a special cause of loss form that provides coverage on an open perils basis insuring against the direct physical loss of, or damage to, covered property including, but not limited to, theft, vandalism, malicious mischief, earthquake, tornado, lightning, explosion, breakage of glass, flood, collapse, water damage, and hot and cold testing. This insurance shall be written on a replacement cost basis and shall also include debris removal, and/or demolition occasioned by enforcement of Applicable Law.

10.4.1.1 The amount of coverage shall be not less than the total completed value of the Project, including the value of permanent fixtures and decorations, with a deductible of not more than $25,000 per occurrence. Any deductible over the amount specified shall be authorized in writing by the Owner and Contracting Authority.

10.4.1.2 The named insureds under the policy shall include the State, Contracting Authority, Owner, Contractor, Subcontractors at all tiers, and Separate Contractors.

10.4.1.3 Coverage shall include a provision to pay the reasonable extra costs of acceleration and expediting temporary and permanent repairs to, or permanent replacement of, damaged property. This shall include overtime wages and the extra cost of "express" or other means for rapidly transporting materials and supplies necessary to the repair or replacement.

10.4.1.4 Coverage shall include "soft cost endorsement" including, but not limited to, the reasonable extra costs of the A/E and reasonable Contractor extension or acceleration costs.

10.4.1.5 Coverage shall include material in transit or stored off-site and identified for the Project.

10.4.1.6 Coverage shall waive all rights between the Owner, Contracting Authority, Contractor, and Subcontractors at any tier, for damages caused by fire or any other perils to the extent of actual recovery of any insurance proceeds under the policy.

10.4.1.7 Coverage shall include appropriate sub-limits for installation coverage.

10.4.1.8 Coverage shall include provisions for mechanical or electrical breakdown, or boiler system testing.

10.4.1.9 Coverage shall include temporary structures and scaffolding, along with collapse coverage.

10.4.1.10 Coverage shall be primary to all other applicable insurance.

10.4.1.11 The builder's risk policy shall specifically permit and allow for Partial Occupancy by the Owner prior to Contract Completion and coverage shall remain in effect until all punch list items are completed.

10.4.1.12 The Contractor's tools and equipment shall not be covered under the builder's risk policy. It is the Contractor's sole responsibility to maintain such coverage, which shall be included in its Overhead (a component of Contractor's Fee) and not included as a separate item in the Contractor's Schedule of Values.

10.4.2 If the Contractor is involved solely in the installation of material and equipment and not in new building construction, the Contractor shall purchase and maintain a builder's risk, builder's risk-renovations, or installation floater insurance policy. The policy shall comply with the provisions of **Section 10.4.1.**

10.5 Waivers of Subrogation

10.5.1 To the fullest extent permitted by Applicable Law, the Contractor waives all rights against the Owner, Contracting Authority, and their agents and employees for damages to the extent covered by any insurance, except rights to the proceeds of that insurance. All policies shall accomplish the waiver of subrogation by endorsement or otherwise.

10.5.2 The Owner, Contracting Authority, and Contractor waive all rights against each other for damages caused by fire or other perils to the extent of actual recovery of any insurance proceeds under any property insurance, inland marine insurance, or builder's risk insurance applicable to the Work.

10.6 Indemnification for Injury or Damage

10.6.1 To the fullest extent permitted by Applicable Law, the Contractor shall indemnify, defend, and hold harmless the Indemnified Parties from and against all claims, costs, damages, losses, fines, penalties, and expenses (including but not limited to all fees and charges of attorneys and other professionals, and all court, arbitration, or other dispute-resolution costs) arising out of or in connection with the Project, provided that any such claim, cost, damage, loss, fine, penalty, or expense is attributable to:

10.6.1.1 bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property but only to the extent caused by the negligent acts, errors, or omissions of the Contractor or a person or entity for whom the Contractor may be liable;

10.6.1.2 infringement of patent rights or copyrights by the Contractor or a person or entity for whom the Contractor may be liable; or

10.6.1.3 a violation of Applicable Law but only to the extent attributable to the Contractor or a person or entity for whom the Contractor may be liable.

10.6.2 The Contractor's indemnification obligation under **Section 10.6** exists regardless of whether or not and the extent to which the claim, damage, loss, fine, penalty, or expense is caused in part by a party indemnified under **Section 10.6**. But nothing in **Section 10.6** obligates the Contractor to indemnify any individual or entity from and against the consequences of that individual or entity's own negligence.

10.6.3 The Contractor's obligations under **Section 10.6** shall not extend to the liability of the A/E, A/E's consultants, agents, representatives, or employees for negligent preparation or approval of Drawings, Specifications, Change Orders, opinions, and any other responsibility of the A/E, except to the extent covered by the Contractor's insurance.

10.6.4 In claims against an Indemnified Party by any direct or indirect employee (or the survivor or personal representative of that employee) of the Contractor or a person or entity for whom the Contractor may be liable, the indemnification obligation under **Section 10.6** will not be limited by a limitation on the amount or type of damages, compensation, or benefits payable under workers' compensation acts, disability benefit acts, or other employee benefit acts.

10.6.5 The Contractor's indemnification obligation under **Section 10.6** will not be limited by any insurance policy provided or required in connection with the Project.

10.6.6 The Contractor's obligations under **Section 10.6** shall not negate, abridge, or reduce other rights or obligations of indemnity, which would otherwise exist as to an Indemnified Party.

10.6.7 The Contractor's indemnification obligation under **Section 10.6** will survive termination of the Contract and Contract Completion.

10.6.8 The Contracting Authority may deduct from the Contract Sum the claims, damages, losses, fines, penalties, and expenses for which the Contractor is liable under **Section 10.6**. If those claims, damages, losses, fines, penalties, and expenses exceed the unpaid balance of the Contract Sum, the Contractor shall immediately pay the difference to the Owner.

ARTICLE 11 - SUSPENSION AND TERMINATION

11.1 Suspension of the Work

11.1.1 The Contracting Authority, without cause and without prejudice to any other right or remedy it may have, may order the Contractor in writing to suspend, delay, or interrupt performance of the Work in whole or in part for such period as the Contracting Authority may determine.

11.1.1.1 If the Contracting Authority suspends the Work under this **Section 11.1.1** and the Contractor complies with **Article 8**, the Contract Sum and Contract Times shall be adjusted for increases in the cost and time caused by the suspension, delay, or interruption. The adjustment of the Contract Sum, however, shall not include profit (a component of Contractor's Fee).

11.1.1.2 Notwithstanding the foregoing, no adjustment shall be made to the Contract Sum or Contract Times to the extent that:

.1 performance was, or could have been, suspended, delayed, or interrupted by a cause for which the Contractor is responsible; or

.2 an equitable adjustment is made or denied under another provision of the Contract.

11.1.1.3 If the Contracting Authority suspends the Work under this **Section 11.1.1** and the Contractor submits a proper Contractor Payment Request, subject to all other provisions of the Contract Documents, the Contractor shall be entitled to payment of compensation due under the Contract Documents for Work performed before the suspension based upon the Schedule of Values.

11.1.2 The Contracting Authority, without prejudice to any other right or remedy it may have, may order the Contractor in writing to suspend, delay, or interrupt the performance of the Work in whole or in part for such period as the Contracting Authority may determine for any of the following reasons: **(1)** Defective Work; **(2)** the Contractor is causing undue risk of damage to any part of the Project or adjacent area; **(3)** the Contractor fails to furnish or perform the Work in such a way that the complete Work will conform to the requirements of the Contract Documents; or **(4)** any other cause the Contracting Authority reasonably believes justifies suspension.

11.1.2.1 The Contracting Authority's exercise of its right to suspend the Work under this **Section 11.1.2** shall not entitle the Contractor to any adjustment of the Contract Sum, Contract Times, or both.

11.1.2.2 If the Contracting Authority is adjudged to have improperly suspended the Work under this **Section 11.1.2**, the suspension shall be deemed to have been a suspension under **Section 11.1.1**.

11.1.3 Upon receipt of notice of suspension under this **Section 11.1**, the Contractor shall cease Work on the suspended activities and take all necessary or appropriate steps to limit disbursements and minimize respective costs. The Contractor shall furnish a report to the Contracting Authority, within 5 days of receiving the notice of suspension, describing the status of the Work, including, but not limited to, results accomplished, resulting conclusions, and other information as the Contracting Authority may require.

11.1.4 The Contracting Authority's right to stop the Work shall not give rise to any duty to exercise the right for the benefit of the Contractor or any other party, and the Contracting Authority's exercise or failure to exercise the right shall not prejudice any of the Contracting Authority's other rights.

11.2 Termination for Convenience

11.2.1 The Contracting Authority may, at any time, terminate the Contract in whole or in part for the Owner's convenience and without cause, at any time upon 10 days' written notice to the Contractor.

11.2.2 Upon receipt of the notice of termination for convenience, the Contractor shall immediately proceed with performance of the following duties in accordance with instructions from the Contracting Authority:

11.2.2.1 cease operation as specified in the notice;

11.2.2.2 place no further orders and enter into no further subcontracts for materials, labor, services, or facilities, except as necessary to complete continued portions of the Project;

11.2.2.3 terminate all subcontracts and orders to the extent they relate to the Work terminated;

11.2.2.4 proceed with Work not terminated; and

11.2.2.5 take actions that may be necessary, or that the Contracting Authority may direct, for the protection and preservation of the terminated Work.

11.2.3 Upon termination, the Contracting Authority shall pay the Contractor in accordance with the Schedule of Values for Work completed, including any retained funds, and the value of materials ordered and delivered, less any salvage credit the Contractor may receive for them.

11.2.3.1 All materials, equipment, facilities, and supplies at the Site or stored off-site, for which the Contractor has received payment, shall become the property of the Owner.

11.2.3.2 The Contractor is entitled to a fair and reasonable profit for Work performed and reasonable expenses directly attributable to termination of the Contract. In no event shall the Contractor be entitled to **(1)** Contractor's Fee on Work not performed or **(2)** compensation in excess of the total Contract Sum.

11.2.4 If the Contracting Authority terminates the Work under this **Section 11.2**, the termination shall not affect the rights or remedies of the State against the Contractor then existing or which may thereafter accrue.

11.2.5 Notwithstanding **Section 11.2.3**, if the Contracting Authority terminates the Work under this **Section 11.2**, but there exists an event of the Contractor's default, the Contractor shall be entitled to receive only such amounts as it would be entitled to receive following the occurrence of an event of default as provided in **Section 11.3**.

11.3 Termination for Cause

11.3.1 The Contracting Authority may terminate all or a portion of the Contract if the Contractor commits a material breach of the Contract including but not limited to:

11.3.1.1 failure to prosecute the Work with the necessary force or in a timely manner;

11.3.1.2 refusal to remedy Defective Work;

11.3.1.3 failure to supply enough properly skilled workers or proper materials;

11.3.1.4 failure to properly make payment to Subcontractors or Consultants;

11.3.1.5 performance of any services outside of the United States;

11.3.1.6 permitting its Subcontractors or Consultants to perform any services outside of the United States; or

11.3.1.7 disregarding laws, ordinances, or rules, regulations, or orders of a public authority with jurisdiction over the Project.

11.3.2 If the Contracting Authority intends to exercise its termination rights under this **Section 11.3**, the Contracting Authority shall issue not less than 5 days' written notice to the Contractor and the Contractor's Surety in accordance with ORC Section 153.17 ("5-Day Notice").

11.3.2.1 Notwithstanding any provision of the Contract to the contrary **(1)** the issuance of a 72-Hour Notice under **Section 6.23.1** is not a condition precedent to the Contracting Authority's exercise of its rights under **Section 11.3** and **(2)** the Contracting Authority's decision to not issue a 72-Hour Notice under **Section 6.23.1** will not prejudice the Contracting Authority's rights under **Section 11.3**.

11.3.3 If the Contractor fails to satisfy the requirements set forth in the 5-Day Notice within 15 days of receipt of the 5-Day Notice, the Contracting Authority may declare the Contractor in default, terminate the Contract, and employ upon the Work the additional force or supply materials or either as appropriate, and remove Defective Work.

11.3.4 If the Contract is terminated, the Contractor's Surety may perform the Contract. If the Contractor's Surety does not commence performance of the Contract within 10 days of the date of Contract termination, the Contracting Authority may complete the Work by means the Contracting Authority determines appropriate. The Contracting Authority may take possession of and use all materials, facilities, and equipment at the Site or stored off-site, for which the State has paid.

11.3.5 If the Contract is terminated, the Contractor shall not be entitled to further payment. If the unpaid balance of the Contract Sum is exceeded by the costs of finishing the Work, including without limitation the fees and charges of engineers, architects, attorneys, and other professionals and court costs, and other damages incurred by the Owner and not expressly waived, the Contractor or Surety shall immediately pay the amount of the insufficiency to the Owner. This obligation for payment shall survive termination of the Contract.

11.3.6 If the Contractor's Surety performs the Work, the provisions of the Contract Documents govern the Surety's performance, with the Surety in place of the Contractor in all provisions including, but not limited to, provisions for payment for the Work, and provisions of the right of the Contracting Authority to complete the Work.

11.3.7 If the Contracting Authority terminates the Contract under this **Section 11.3**, the termination shall not affect any rights or remedies of the State against the Contractor then existing or which may thereafter accrue. The Contracting Authority's retention or payment of funds due the Contractor shall not release the Contractor or the Contractor's Surety from liability for performance of the Work in accordance with the requirements of the Contract Documents.

11.3.8 If the Contracting Authority is adjudged to have improperly terminated the Contract under this **Section 11.3**, the termination will be deemed to have been a termination under **Section 11.2**.

11.4 Contractor Insolvency

11.4.1 Bankruptcy of Contractor.

11.4.1.1 If the Contractor files a voluntary petition in bankruptcy or has an involuntary petition in bankruptcy filed against it, the Contractor, the Contractor as the debtor-in-possession, or the trustee of the Contractor's bankruptcy estate shall file a motion to assume or reject the Contract under Bankruptcy Code §365, 11 U.S.C. §365, within 20 days after the filing of the voluntary petition or involuntary petition and shall diligently prosecute that motion to conclusion so as to obtain an order granting or denying that motion within 45 days after the filing of the voluntary or involuntary petition. The failure to file and prosecute that motion within the time limits provided by this **Section 11.4** shall constitute a material breach of the Contract as time is of the essence with respect to Contractor's performance of all terms of this Contract. The Contractor agrees to the granting of relief from the automatic stay of

the Bankruptcy Code, 11 U.S.C. §362(a), to permit the Contracting Authority to terminate the Contract for cause in such instance and issue and serve all notices necessary to terminate the Contract or arising out of the termination of the Contract and to take any and all other action necessary to terminate the Contract.

11.4.2 Receivership or Assignment for the Benefit of Creditors.

11.4.2.1 If the Contractor makes a general assignment for the benefit of creditors or if a receiver is appointed for all or a substantial part of the Contractor's business or property, the Contracting Authority shall serve written notice on the Contractor and Contractor's Surety stating that any failure of the Contractor to provide adequate assurance of continued performance shall be considered a rejection of the Contract, which shall result in termination of the Contract for cause. Such termination of the Contract need not be evidenced by an order of any court.

ARTICLE 12 - GENERAL PROVISIONS

12.1 Contractor's Documents and Contract Documents

12.1.1 Ownership.

12.1.1.1 The Owner alone owns the Contractor's Documents and the Contract Documents and every right, title, and interest therein.

.1 The Contractor must execute and deliver and cause its employees and agents and all Subcontractors and Consultants to execute and deliver, to the Owner any transfers, assignments, documents, or other instruments (if any) necessary to vest in the Owner complete right, title, interest in and ownership of the Contractor's Documents and the Contract Documents.

12.1.1.2 The Contractor may retain copies, including reproducible copies, of the Contractor's Documents and the Contract Documents for information, reference, and performance of the Work.

12.1.1.3 The submission or distribution of the Contractor's Documents or the Contract Documents to meet official regulatory requirements or for similar purposes in connection with the Project is not a waiver of the Owner's reserved rights in the Contractor's Documents and the Contract Documents. Any unauthorized use of the Contractor's Documents or the Contract Documents shall be at the sole risk of the entity making the unauthorized use.

12.1.1.4 The Contractor shall provide Electronic Files (in native format) to Separate Consultants and Separate Contractors for their use in connection with the Project. The Contractor shall provide the Electronic Files **(1)** at no additional cost to the Separate Consultants, Separate Contractors, and Owner and **(2)** without requiring the Separate Consultants, Separate Contractors, or Owner to agree to any terms or conditions concerning the provision, receipt, or use of the Electronic Files that differ in any material respect from the Contract.

12.1.2 Intent.

12.1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor.

12.1.2.2 The Contract Documents are complementary, and what is required by one is binding as if required by all.

12.1.2.3 The Contractor shall provide all labor and materials necessary for the entire completion of the Work described in the Contract Documents and reasonably inferable to produce the intended results.

12.1.2.4 The Drawings govern dimensions, details, and locations of the Work. The Specifications govern quality of materials and workmanship.

12.1.2.5 The organization of the Specifications in divisions, sections, and articles, and the arrangement of Drawings shall not restrict the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

12.1.2.6 In the event of inconsistency or conflict within the Contract Documents, the Contractor shall provide the better quality or greater quantity of Work, and comply with the stricter requirement.

12.1.2.7 Unless otherwise defined in the Contract Documents, words that have well-known technical or construction industry meanings are used in accordance with those recognized meanings.

12.1.2.8 The Sections of Division 01 - "General Requirements" govern the performance of the Work of all Sections of the Specifications.

12.1.3 Use of Electronic Files.

12.1.3.1 The Owner, Contracting Authority, A/E, and Contractor reasonably expect that they will provide Electronic Files to each other to facilitate the design and construction of the Project consistent with current practices and customs in the construction industry.

12.1.3.2 The Owner, Contracting Authority, A/E, and Contractor acknowledge that the use of Electronic Files involves risks not generally associated with the use of paper documents. Those risks include, for example and without limitation, alteration (inadvertent or intentional) and deterioration, both of which may not be readily apparent through casual observation.

12.1.3.3 The Owner, Contracting Authority, A/E, and Contractor do not warrant to each other that any Electronic File they provide **(1)** was not altered though transmission; **(2)** is compatible with the recipient's computer system or software; **(3)** will not be altered through degradation of the recipient's storage media; or **(4)** is suitable for conversion/translation to and subsequent use in a system or format other than the Electronic File's original system or format.

12.1.3.4 Before relying on any Electronic File it receives, the recipient is responsible for verifying that the Electronic File was not altered though transmission, degradation of the recipient's own storage media, or other causes.

12.1.3.5 If the recipient of an Electronic File converts/translates the Electronic File from its original system or format to an alternate system or format, the recipient assumes the risk that the conversion/translation created errors in the converted/translated file.

12.1.3.6 The Owner, Contracting Authority, A/E, and Contractor shall each maintain and operate its own computer systems and storage media in a commercially reasonable way and take reasonable steps to prevent errors in and deterioration of the Electronic Files it creates, provides, and receives.

12.1.3.7 In the event of a discrepancy between information contained in a paper version of a document and the Electronic File of that document, the paper version will govern.

12.1.3.8 This **Section 12.1.3** does not relieve the Contractor of its responsibility for the preparation, completeness, or accuracy of the Contractor's Documents.

12.2 Public Relations

12.2.1 Publicity prior to completion of the Project. Prior to completion of the Project, public relations or publicity about the Project shall be solely within the control, and with the consent of, the Owner.

12.2.2 Publicity after completion of the Project. After completion of the Project, the Contractor may exercise reasonable public relations and marketing efforts related to the Project, provided the Contractor properly identifies the Owner and Contracting Authority, and their participation in the Project.

12.2.3 Professional Photography. If the Contractor commissions photography of the completed Project, the Contractor shall include in its photography agreements a release for unrestricted and unlimited use of photographs by the Owner and Contracting Authority, and shall provide the Owner and Contracting Authority with a reasonable quantity of photographs for use in the Owner's and the Contracting Authority's marketing and awareness activities, including, but not limited to, profiles of the Project on their respective websites.

12.2.4 Craft Awards and Other Recognition. If the Contractor submits the Project for craft awards or other similar venues for recognition of the Project, the Contractor shall properly identify the Owner and Contracting Authority, and their participation in the Project. In addition, if the Project receives any craft award or other recognition, the Contractor shall provide duplicate copies of the award plaque or other memento of the award to the Owner and Contracting Authority.

12.3 Application and Governing Law

12.3.1 The Contract and the rights of the parties thereunder shall be governed by the laws of the state of Ohio and only Ohio courts shall have jurisdiction over any action or proceeding concerning the Contract and/or performance thereunder. The Contractor irrevocably consents to such jurisdiction.

12.3.2 The parties to the Contract shall comply with Applicable Law.

12.3.3 Other rights and responsibilities of the Contractor, A/E, Contracting Authority, and Owner are set forth throughout the Contract Documents and included under different titles, articles, and paragraphs for convenience.

12.4 Conditions of the Contract

12.4.1 These General Conditions govern, take precedence over, and shall not be superseded or amended by Drawings and Specifications, unless so provided in Supplementary Conditions prepared by the Contracting Authority and approved by the Ohio Facilities Construction Commission.

12.5 Notice of Commencement.

12.5.1 The Contracting Authority shall prepare a Notice of Commencement and make it available as required under ORC Section 1311.252.

12.5.2 Upon request, the Contracting Authority or the Contractor shall furnish the Notice of Commencement to Subcontractors or any other member of the public.

12.6 Written Notice

12.6.1 Notice under the Contract Documents shall be validly given if:

12.6.1.1 delivered personally to a member of the organization for whom the notice is intended;

12.6.1.2 delivered, or sent by registered or certified mail, to the last known business address of the organization; or

12.6.1.3 sent by facsimile, email, or web-based project management software, provided the original, signed document is delivered within 3 business days after the date of the electronic transmission.

12.6.2 When the Owner, Contracting Authority, A/E, or Contractor gives notice to one of the other 3, it shall also simultaneously send a copy of that notice to the others.

12.6.3 A copy of all notices, certificates, requests, or other communications to the Contracting Authority shall be sent to the Project Manager.

12.6.4 In the event of an emergency involving the Project, including, but not limited to, a fatality, serious injury, fire, collapse, flood, utility, or power loss to occupied facilities, explosion, or environmental damage, the Contractor shall immediately notify the A/E, Contracting Authority, and Owner by telephone.

12.6.5 The Contracting Authority, Owner, A/E, or Contractor may, by written notice given hereunder, designate addresses, telephone numbers, email addresses, or facsimile numbers to which notices, certificates, requests, or communications shall be sent.

12.7 Taxes

12.7.1 Only those materials that ultimately become a part of the completed structure or improvement that constitutes the Project shall be exempt from state sales tax and state use tax.

12.7.2 The purchase, lease, or rental of material, equipment, parts, or expendable items as concrete form lumber, tools, oils, greases, and fuels, which are used in connection with the Work, are subject to the application of state sales tax and state use tax.

12.8 Computing Time

12.8.1 When the Contract Documents refer to a period of time by a number of days, the period shall be computed to exclude the first and include the last day of the period. If the last day of the period falls on a Saturday, Sunday, or a legal holiday, that day shall be omitted from the computation and the period shall end on the next succeeding day that is not a Saturday, Sunday, or legal holiday.

12.8.2 Except as excluded under **Section 12.8.1**, the Contract Times and all other periods referred to in the Contract Documents includes Saturdays, Sundays, and all days defined as legal holidays by **Section 12.8.4**.

12.8.3 The standard workdays for State projects are Monday through Friday, excluding legal holidays.

12.8.4 Legal holidays are as follows:

12.8.4.1 New Year's Day – First Day in January;

12.8.4.2 Martin Luther King Jr. Day – Third Monday in January;

12.8.4.3 Washington-Lincoln (President's) Day – Third Monday in February;

12.8.4.4 Memorial Day – Last Monday in May;

12.8.4.5 Juneteenth Day – Nineteenth Day of June;

12.8.4.6 Independence Day – Fourth day of July;

12.8.4.7 Labor Day – First Monday in September;

12.8.4.8 Columbus Day – Second Monday in October;

12.8.4.9 Veterans' Day – Eleventh Day of November;

12.8.4.10 Thanksgiving Day – Fourth Thursday of November; and

12.8.4.11 Christmas Day – Twenty-fifth day of December.

12.8.5 If a legal holiday falls on a Saturday, it is observed on the preceding Friday. If a legal holiday falls on a Sunday, it is observed on the following Monday.

12.9 Time of the Essence

12.9.1 Time limits stated in the Contract Documents are of the essence of the Contract and all obligations under the Contract. By signing the Agreement, the Contractor acknowledges that the Contract Times are reasonable, taking into consideration the usual weather and other conditions prevailing in the locality of the Project. By signing the Construction Schedule, the Contractor acknowledges that the specified Milestone dates are reasonable, taking into consideration the usual weather and other conditions prevailing in the locality of the Project.

12.9.1.1 The Notice to Proceed establishes the date for commencement of the Work.

12.9.1.2 The Contractor acknowledges that the Owner has entered into, or may enter into, agreements for use of all or part of the premises where the Work is to be completed based upon the Contractor achieving Contract Completion within the associated Contract Time.

12.9.1.3 The Contractor shall perform the Work in a reasonable, efficient, and economical sequence, and in the order and time as provided in the Construction Progress Schedule.

12.9.1.4 The Contractor acknowledges that it may be subject to interference, disruption, hindrance, or delay in the progress of the Work from any cause. The sole remedy for such interference, disruption, hindrance, or delay shall be an extension of the Contract Times under **Article 8**, unless otherwise required by ORC Section 4113.62.

12.10 Successors and Assigns

12.10.1 The Contracting Authority and Contractor each bind themselves, their successors, assigns, and legal representatives, to the other party to this Contract and to the successors, assigns, and legal representatives of the other party with respect to all terms of this Contract.

12.10.2 The Contracting Authority and Contractor each acknowledge that the Owner is an intended third-party beneficiary of this Contract.

12.10.3 The Contractor shall not assign, or transfer any right, title, or interest in this Contract without the Contracting Authority's prior written consent.

12.11 Extent of Contract

12.11.1 Entire Contract. The Contract Documents represent the entire and integrated agreement between the Contracting Authority and Contractor and supersede all prior negotiations, representations, or agreements, either written or oral.

12.11.2 Multiple Counterparts. This Contract may be executed in any number of counterparts, each of which shall be regarded as an original and all of which shall constitute but one and the same instrument.

12.11.3 Captions. The captions and headings in this Contract are for convenience only and in no way define, limit, or describe the scope or intent of any provisions or sections hereof.

12.11.4 Precedence. If there are any inconsistencies between the provisions of the Contract Documents and the provisions of the Contract, the provisions of this Contract shall prevail.

12.12 Severability

12.12.1 If any term or provision of this Contract or the application thereof to any Person or circumstance, is finally determined to be invalid or unenforceable by a court of competent jurisdiction, the remainder of this Contract or the application of such term or provision to other Persons or circumstances, shall not be affected thereby, and each term and provision of this Contract shall be valid and enforced to the fullest extent permitted by Applicable Law.

12.13 Electronic and Facsimile Signatures

12.13.1 Any party hereto may deliver a copy of its counterpart signature page to this Contract via electronic signature software, fax, e-mail, or web-based project management software. Each party hereto shall be entitled to rely upon an electronic, scanned, or facsimile signature of any other party delivered in such a manner as if such signature were an original.

12.14 No Third-Party Interest

12.14.1 Except as expressly provided under **Sections 6.2.3** through **6.2.5** and **Section 12.10.2**, **(1)** no person or entity, other than the Contracting Authority and Contractor, will have any right or interest under the Contract, and **(2)** the Contract does not create a contractual relationship of any kind between any people or entities other than the Contracting Authority and Contractor.

12.15 Ohio Retirement System

12.15.1 All individuals employed by the Contractor that provide personal services to the Contracting Authority or Owner are not public employees for the purposes of ORC Chapter 145, as amended.

12.15.2 If the Contractor is a PERS retirant, as defined by ORC Section 145.38, the Contractor shall notify the Contracting Authority of such status in writing prior to commencement of Work. The Contracting Authority, Owner, or State is not responsible for changes to the Contractor's retirement benefits resulting from entering into this Contract.

12.16 No Waiver

12.16.1 The failure of the Contracting Authority or Contractor to insist in any one or more instances upon the strict performance of any one or more of the provisions of the Contract or to exercise any rights under the Contract or provided by law will not be construed as a waiver or relinquishment of that provision or right or of the right to subsequently demand strict performance or exercise the right and the rights will continue unchanged and remain in full force and effect.

12.17 Rights and Remedies

12.17.1 The duties, obligations, rights, and remedies under the Contract are in addition to and not a limitation of the duties, obligations, rights, and remedies otherwise imposed by or available under Applicable Law.

12.18 Survival of Obligations

12.18.1 All representations, indemnity obligations, warranties, guarantees, and necessarily continuing obligations under the Contract, will survive final payment, completion and acceptance of the Work, and termination or completion of the Contract.

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END OF DOCUMENT

Document 00 73 00 - Supplementary Conditions (GC)
State of Ohio Standard Requirements for Public Facility Construction

Certifications

These Supplementary Conditions amend and supplement the General Conditions and other provisions of the Contract Documents as indicated below. All provisions not amended remain in full force and effect. The terms in these Supplementary Conditions defined in the Contracting Definitions or the General Conditions shall have the meanings assigned to them in those documents.

These Supplementary Conditions are authorized, by the Ohio Facilities Construction Commission, for use on projects constructed by the Ohio Facilities Construction Commission for the Ohio Department of Rehabilitation & Correction.

Contracting Authority

Ohio Facilities Construction Commission
30 W. Spring Street
Columbus, Ohio 43215
(614) 466-6290
www.ofcc.ohio.gov

MODIFICATIONS TO GENERAL CONDITIONS

Insert Section 7.10 and subordinate Sections as follows:

7.10 Weather Delays

7.10.1 The parties expect adverse weather to delay the Work to some extent and have included in the Contract Times a certain number of Work Days lost on account of adverse weather as follows:

Month	Expected Number of Work Days Lost Due to Weather
January	8
February	8
March	7
April	6
May	5
June	5
July	4
August	4
September	5
October	6
November	6
December	6

7.10.2 The contractor will not be entitled to an extension of the Contract Time on account of adverse weather unless the actual number of Work Days lost due to adverse weather in a particular calendar month exceed the expected

number of Work Days lost in that calendar month due to adverse weather. The Contractor must reconcile lost Work Days with the A/E on a weekly basis.

7.10.3 A Work Day will be "lost" if adverse weather reduces the Contractor's efficiency on the Work on the critical path that Work Day to less than 50%. The Contractor shall substantiate its claim that its efficiency on the Work on the critical path that Work Day was less than 50%.

7.10.4 If the Contractor reasonably believes that it is entitled to an extension of the Contract Times on account of Work Days lost due to adverse weather in a particular month. For the Ohio Department of Rehabilitation & Correction, adverse weather shall also constitute lost time due to Fog as related to exterior work. The Contractor may request a Change Order by giving written notice under Section **7.3.2** within ten days after the last calendar day of that month.

*Delete Section **8.4.2** in its entirety.*

*Replace Section **9.8.2.8** with the following:*

9.8.2.8 failure to maintain schedules in a contract compliant status;

Expected adverse weather days based on the Chart in this section, nullifies 01 32 16 Specification Section 3.2.J.2.b.1 & 2.

END OF DOCUMENT

Document 00 73 43 - Wage Rate Requirements
State of Ohio Standard Requirements for Public Facility Construction

PREVAILING WAGE RATES

1.1 Payment of Prevailing Wage Rates

1.1.1 The Contractor shall pay the prevailing wage rates of the Project locality, as issued by the Ohio Department of Commerce, Wage and Hour Bureau to laborers and mechanics performing Work on the Project.

1.1.2 The Contractor shall comply with the provisions, duties, obligations, and is subject to the remedies and penalties of ORC Chapter 4115.

1.1.3 If the Contractor or its Subcontractors fail to comply with ORC Chapter 4115, the Contracting Authority may withhold payment pursuant to **Section 9.8.2.5** of the **General Conditions**. The Contractor is liable for violations committed by the Contractor or its Subcontractors to the extent provided in ORC Chapter 4115.

1.1.4 The Contractor shall submit all payroll reports in compliance with the requirements of **Section 1.2** for all employees of the Contractor and of the Contractor's Subcontractors.

1.1.5 By executing a Contract, the Contractor certifies that it based its Bid upon the prevailing rates of wages as ascertained by the Ohio Department of Commerce, Wage and Hour Bureau for the Project as provided in ORC Sections 4115.03 through 4115.14, which are inserted at the end of this Document.

1.2 Prevailing Wage Rate Revisions

1.2.1 The Contracting Authority shall, within 7 business days after receipt of a notice of a change in the prevailing wage rates, notify the Contractor of the change. The prevailing wage rates are available at the Ohio Department of Commerce's web site: http://com.state.oh.us/.

1.2.2 The Contractor shall pay any revised wage rates issued during the term of the Contract.

1.3 Payroll Schedule

1.3.1 Within 10 days of the date of the Notice to Proceed, the Contractor shall provide the Contracting Authority's Prevailing Wage Coordinator a schedule of dates during the term of the Contract on which wages shall be paid to employees for the Project.

1.4 Payroll Reports

1.4.1 The Contractor shall submit payroll reports with each Contractor Payment Request, which reports shall be certified by the Contractor that the payroll is correct and complete, and that the wage rates shown are not less than those required by the Contract. The Contractor is responsible for submitting all payroll reports of its Subcontractors.

1.4.1.1 Each payroll report shall indicate the period covered and include a list containing the name, address, and last four digits of the social security number of each employee of the Contractor and its Subcontractors paid for the Work.

1.4.1.2 Each payroll report shall list the number of hours each employee worked each day on the Project during the reporting period, the total hours each week on the Project, the employee's hourly rate of pay, job classification, hourly rate of fringe benefits, and all deductions from wages and net pay.

1.4.1.3 Each payroll report shall list each fringe benefit and state if it is paid as cash to the employee or to a named plan.

1.4.1.4 The Contractor and its Subcontractors shall submit apprenticeship agreements for all apprentices utilized on the Project with the first payroll report from the Contractor or its Subcontractor that includes apprentices.

END OF DOCUMENT

An Official State of Ohio site. Here's how you know

Prevailing Wage Project Registration

Public Authority Information

Owner/Public Authority Name	OFCC
Department Division or Agency	ODRC
Street Address	PO Box 430
Address 2	
City, OH	Columbus, Ohio, OH
ZIP	43216
Email	sylvia.slivo@ofcc.ohio.gov
County of Public Authority	Franklin
P.A. Phone	6143073563

Date: 9/9/2025

This form must be filled out completely & correctly for us to process your request. Forms not completed correctly will be returned to the sender.

Project Information

Project Name	LOCI Auto School renovation
Site Address	1580 OH-56
City, OH	London, Ohio, OH
ZIP	43140
County of Project	Madison

Prevailing Wage Coordinator Name	Sylvia Slivo
Address	30 west spring street 4th floor
City	Columbus, Ohio
ZIP	43215
Phone	6143073563
Issuing Authority of Bonds	
Estimated Total Overall Project Cost	3,000,000
Type of Financing	
Type of Construction	NewConstruction
This Project is	Commercial
Expected Date of Contract Award	10/20/2025
Projected Completion Date	10/20/2026
Project Comments	DRC-23L009

Prevailing Wage Rate
Skilled Crafts

Name of Union: Asbestos Local 207

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Asbestos Worker	8/6/2025	8/6/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Asbestos Abatement	$32.50		$10.95	$7.25	$0.75	$3.75	$0.00	$0.05	$0.00	$0.00	$55.25	$71.50
Apprentice	BHR	Percent										
Trainee	$22.00	$67.69	$10.95	$1.90	$0.75	$1.00	$0.00	$0.05	$0.00	$0.00	$36.65	$47.65

(*)Special Calculation Note :

Other: Drug Testing

Ratio :

3 Journeymen to 1 Trainee

Jurisdiction (* denotes special jurisdictional note) :

Adams, Ashland, Ashtabula*, Athens, Auglaize, Brown, Butler*, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Delaware, Erie*, Fairfield, Fayette, Franklin, Geauga, Greene, Guernsey, Hamilton, Hardin, Harrison, Highland, Hocking, Holmes, Huron, Knox, Lake, Licking, Logan, Lorain, Madison, Mahoning, Marion, Medina, Miami, Montgomery, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Portage, Preble, Richland, Ross, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Vinton, Warren*, Wayne

Special Jurisdictional Note :

Ashtabula County: (post offices & townships of Ashtabula, Austinburg, Geneva, Harperfield, Jefferson, Plymouth & Saybrook) (townships of Andover, Cherry Valley, Colbrook, Canneaut, Denmark, Dorset, East Orwell, Hartsgrove, Kingville, Lenox, Monroe,Morgan,New Lyme,North Kingsville, Orwell, Pierpoint, Richmond Rock Creek, Rome, Shefield, Trumbull, Wayne, Williamsfield & Windsor)

Butler County: (townships of Fairfield, Hanover, Liberty, Milford, Morgan, Oxford, Ripley, Ross, St. Clair, Union & Wayne) (Lemon & Madison)

Erie County: (post offices & townships of Berlin, Berlin Heights,Birmingham,Florence, Huron, Milan, Shinrock & Vermilion)

Warren County: (townships of: Deerfield, Hamilton, Harlan, Salem, Union & Washington) (Clear Creek, Franklin, Mossie, Turtle Creek & Wayne)

Details :

An Abatement Journeyman is anyone who has more than 600 hours in the Asbestos Abatement field.

Asbestos & lead paint abatement including, but not limited to the removal or encapsulation of asbestos & lead paint, all work in conjunction with the preparation of the removal of same & all work in conjunction with the clean up after said removal. The removal of all insulation materials, whether they contain asbestos or not, from mechanical systems (pipes, boilers, ducts, flues, breaching, etc.) is recognized as being the exclusive work of the Asbestos Abatement Workers.

On all mechanical systems (pipes, boilers, ducts, flues, breaching, etc.) that are going to be demolished, the removal of all insulating materials whether they contain asbestos or not shall be the exclusive work of the Laborers.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Asbestos Local 50 Heat & Frost Insulators

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN02-2025ib	Asbestos Worker	7/30/2025	7/30/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Asbestos Insulation Mechanic	$40.56		$9.55	$9.60	$0.55	$0.00	$4.75	$0.00	$0.00	$0.00	$65.01	$85.29
Firestop Technician	$40.56		$9.55	$9.60	$0.55	$0.00	$4.75	$0.00	$0.00	$0.00	$65.01	$85.29
Apprentice	BHR	Percent										
1st year	$25.81	$63.63	$9.55	$4.52	$0.50	$0.00	$0.50	$0.00	$0.00	$0.00	$40.88	$53.78
2nd year	$30.11	$74.23	$9.55	$4.52	$0.50	$0.00	$0.85	$0.00	$0.00	$0.00	$45.53	$60.59
3rd year	$34.41	$84.83	$9.55	$6.76	$0.50	$0.00	$1.25	$0.00	$0.00	$0.00	$52.47	$69.67
4th year	$36.56	$90.13	$9.55	$6.76	$0.50	$0.00	$1.50	$0.00	$0.00	$0.00	$54.87	$73.15

(*)Special Calculation Note :

Ratio :

1 Journeymen to 1 Apprentice
4 Journeymen to 1 Apprentice thereafter

Jurisdiction (* denotes special jurisdictional note) :

Athens, Auglaize, Butler*, Champaign, Clark, Clinton, Crawford, Darke, Delaware, Fairfield, Fayette, Franklin, Greene, Guernsey, Hardin, Hocking, Knox, Licking, Logan, Madison, Marion, Miami, Montgomery, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Preble, Ross, Shelby, Union, Vinton, Warren*

Special Jurisdictional Note :

Butler County: Townships of Lemon and Madison.
Warren County: Township of Clear Creek, Franklin, Massie, Turtle Creek and Wayne

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Boilermaker Local 105

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN02-2013fb	Boilermaker	10/1/2013	10/1/2013

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Boilermaker	$35.26		$7.07	$13.28	$0.89	$0.00	$3.00	$0.55	$0.00	$0.00	$60.05	$77.68
Apprentice	BHR	Percent										
1st 6 months	$24.69	$70.03	$7.07	$11.30	$0.89	$0.00	$2.10	$0.55	$0.00	$0.00	$46.60	$58.95
2nd 6 months	$26.45	$75.02	$7.07	$11.30	$0.89	$0.00	$2.25	$0.55	$0.00	$0.00	$48.51	$61.74
3rd 6 months	$28.21	$80.00	$7.07	$11.30	$0.89	$0.00	$2.40	$0.55	$0.00	$0.00	$50.42	$64.52
4th 6 months	$29.98	$85.02	$7.07	$11.30	$0.89	$0.00	$2.55	$0.55	$0.00	$0.00	$52.34	$67.33
5th 6 months	$30.86	$87.52	$7.07	$13.28	$0.89	$0.00	$2.63	$0.55	$0.00	$0.00	$55.28	$70.71
6th 6 months	$31.74	$90.03	$7.07	$13.28	$0.89	$0.00	$2.70	$0.55	$0.00	$0.00	$56.23	$72.11
7th 6 months	$32.62	$92.50	$7.07	$13.28	$0.89	$0.00	$2.78	$0.55	$0.00	$0.00	$57.19	$73.49
8th 6 months	$33.50	$95.00	$7.07	$13.28	$0.89	$0.00	$2.85	$0.55	$0.00	$0.00	$58.14	$74.89

(*)Special Calculation Note :

Other is Supplemental Health and Welfare

Ratio :

5 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Athens, Brown, Butler, Champaign, Clark, Clermont, Clinton, Fairfield, Fayette, Franklin, Gallia, Greene, Guernsey, Hamilton, Highland, Hocking, Jackson, Lawrence, Licking, Madison, Meigs, Miami, Montgomery, Morgan, Muskingum, Noble, Perry, Pickaway, Pike, Preble, Ross, Scioto, Vinton, Warren

Special Jurisdictional Note :

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Bricklayer Local 23 (Columbus Tile Finisher)

Type of Rate: Commercial

Change #: LCN01-2025ib

Craft: Bricklayer

Effective Date: 6/1/2025

Effective Date: 6/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Bricklayer Tile Marble Finisher	$31.75		$8.72	$3.24	$0.55	$0.00	$0.50	$0.00	$0.00	$0.00	$44.76	$60.64
Terrazzo Finisher	$32.00		$8.72	$3.24	$0.55	$0.00	$0.50	$0.00	$0.00	$0.00	$45.01	$61.01
Floor Grinder	$32.25		$8.72	$3.24	$0.55	$0.00	$0.50	$0.00	$0.00	$0.00	$45.26	$61.39
Base Grinder	$32.50		$8.72	$3.24	$0.55	$0.00	$0.50	$0.00	$0.00	$0.00	$45.51	$61.76
Apprentice	BHR	Percent										
1st Year	$22.23	$70.00	$8.72	$3.24	$0.55	$0.00	$0.50	$0.00	$0.00	$0.00	$35.24	$46.35
2nd Year	$25.40	$80.00	$8.72	$3.24	$0.55	$0.00	$0.50	$0.00	$0.00	$0.00	$38.41	$51.11
3rd Year	$28.58	$90.00	$8.72	$3.24	$0.55	$0.00	$0.50	$0.00	$0.00	$0.00	$41.59	$55.87
Apprentice Improver	$15.88	$50.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$15.88	$23.81

(*)Special Calculation Note :

Ratio :

1-2 Journeymen to 1 Apprentice 3-5Journeymen to 2 Apprentice Crews larger than 5: 4 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Athens, Coshocton, Delaware, Fairfield, Fayette, Franklin, Guernsey, Hocking, Jackson, Knox, Licking, Madison, Meigs, Morgan, Muskingum, Noble, Perry, Pickaway, Pike, Ross, Union, Vinton, Washington

Special Jurisdictional Note :

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Bricklayer Local 23 (Columbus Tile Setter)

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Bricklayer	6/1/2025	6/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Bricklayer Tile Setter	$33.89		$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$52.69	$69.64
Marble Mason	$33.89		$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$52.69	$69.64
Terrazzo Worker	$34.14		$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$52.94	$70.01
Terrazzo Worker, Installation	$34.14		$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$52.94	$70.01
Apprentice	BHR	Percent										
1st Year	$23.72	$70.00	$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$42.52	$54.38
2nd Year	$27.11	$80.00	$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$45.91	$59.47
3rd Year	$30.50	$90.00	$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$49.30	$64.55
4th Year	$32.20	$95.00	$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$51.00	$67.09

(*)Special Calculation Note :

Ratio :

1 - 3 Journeyman to 1 Apprentice 4 - 8 Journeyman to 2 Apprentice 9 - 13 Journeyman to 3 Apprentice 14 - 18 Journeyman to 4 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Athens, Coshocton, Delaware, Fairfield, Fayette, Franklin, Guernsey, Hocking, Jackson, Knox, Licking, Madison, Meigs, Morgan, Muskingum, Noble, Perry, Pickaway, Pike, Ross, Union, Vinton, Washington

Special Jurisdictional Note :

Noble County: (Townships of Beaver, Buffalo, Seneca & Wayne)

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Bricklayer Local 23 (Columbus)

Type of Rate: Commercial

Change #: LCN01-2025ib

Craft: Bricklayer

Effective Date: 6/1/2025

Effective Date: 6/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Bricklayer	$37.35		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$58.86	$77.54
Lay Out Man	$37.85		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$59.36	$78.29
Saw Man	$37.85		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$59.36	$78.29
Stone & Cement Mason	$37.35		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$58.86	$77.54
Pointer Caulker Cleaner Block Stone	$37.35		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$58.86	$77.54
Plaster	$37.35		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$58.86	$77.54
Swing Stage (Ground Floors thru 23 Floors)	$38.35		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$59.86	$79.04
Swing Stage (24th Floors and Above	$39.35		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$60.86	$80.54
Apprentice	BHR	Percent										
1st Year	$26.15	$70.00	$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$47.66	$60.73
2nd Year	$29.88	$80.00	$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$51.39	$66.33
3rd Year	$33.62	$90.00	$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$55.13	$71.93
4th Year	$35.48	$95.00	$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$56.99	$74.73
MASON TRAINEES	$	$	$	$	$	$	$	$	$	$	$	$
1-90 Days	$18.68	$50.02	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$18.68	$28.02
90-365 Days	$18.68	$50.02	$10.48	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$29.16	$38.50
2nd Year	$20.54	$55.00	$10.48	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$31.02	$41.29

(*)Special Calculation Note :

No special calculations for this skilled craft wage rate are required at this time.

Ratio :

REQUIRED RATIO 1-2 Journeyman to 1 Apprentice 3- 6 Journeyman to 2 Apprentice 7-10 Journeyman to 3 Apprentice 1-15 Journeyman to 4 Apprentice MASON TRAINEE REQUIRED RATIO 1 Apprentice permits 1 Mason Trainee 2 Apprentice permits 1 Mason Trainee 3 Apprentice permits 2 Mason Trainee 4 Apprentice permits 2 Mason Trainee

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Franklin, Madison, Pickaway, Union

Special Jurisdictional Note :

Details :

MASON TRAINEE: duties shall be to work in all aspects of Masonry construction taking direction from the employer and the Journeyman Bricklayer & Stone Mason's working on the job. MASON TRAINEE may work on job site only when a registered apprentice is on job and the ratios in above table will be strictly enforced. Above Journeyman Rate: Brick Power Saw Pay $.50 Designated layout person $.50 Swingstage Work $1.00 at start,and additional $2.00 at 24th floor

Prevailing Wage Rate
Skilled Crafts

Name of Union: Bricklayer Local 23 Heavy Hwy (A)

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2024ib	Bricklayer	6/5/2024	6/5/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Cement Mason Bricklayer Sewer Water Works A	$33.39		$10.00	$9.53	$0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$53.45	$70.15
Apprentice	BHR	Percent										
1st year	$23.37	$70.00	$10.00	$9.53	$0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$43.43	$55.12
2nd year	$26.71	$80.00	$10.00	$9.53	$0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$46.77	$60.13
3rd year	$30.05	$90.00	$10.00	$9.53	$0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$50.11	$65.14

(*)Special Calculation Note :

NOT FOR BUILDING CONSTRUCTION.

Ratio :

3 Journeymen to 1 Apprentice 6 Journeymen to 2 Apprentice 9 Journeymen to 3 Apprentice 12 Journeymen to 4 Apprentice 15 Journeymen to 5 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Gallia, Geauga, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Lucas, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Portage, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne

Special Jurisdictional Note :

Details :

(A) Highway Construction, Sewer, Waterworks And Utility Construction, Industrial & Building Site Heavy Construction, Airport Construction Or Railroad Construction Work. (B) Power Plant, Tunnels, Amusement Park, Athletic Stadium Site Work ,Pollution Control,Sewer Plant, Waste Plant, & Water Treatment Facilities, Construction.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Bricklayer Local 23 Heavy Hwy (B)

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2024ib	Bricklayer	6/5/2024	6/5/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Cement Mason Bricklayer Power Plants Tunnels Amusement Parks B	$34.39		$10.00	$9.52	$0.54	$0.00	$0.00	$0.00	$0.00	$0.00	$54.45	$71.65
Apprentice	BHR	Percent										
1st year	$24.07	$70.00	$10.00	$9.52	$0.54	$0.00	$0.00	$0.00	$0.00	$0.00	$44.13	$56.17
2nd year	$27.51	$80.00	$10.00	$9.52	$0.54	$0.00	$0.00	$0.00	$0.00	$0.00	$47.57	$61.33
3rd year	$30.95	$90.00	$10.00	$9.52	$0.54	$0.00	$0.00	$0.00	$0.00	$0.00	$51.01	$66.49

(*)Special Calculation Note :

NOT FOR BUILDING CONSTRUCTION.

Ratio :

3 Journeymen to 1 Apprentice 6 Journeymen to 2 Apprentice 9 Journeymen to 2 Apprentice 12 Journeymen to 4 Apprentice 15 Journeymen to 5 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Gallia, Geauga, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Lucas, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Portage, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne

Special Jurisdictional Note :

Details :

(A) Highway Construction, Sewer, Waterworks And Utility Construction, Industrial & Building Site Heavy Construction, Airport Construction Or Railroad Construction Work. (B) Power Plant, Tunnels, Amusement Park, Athletic Stadium Site Work ,Pollution Control,Sewer Plant, Waste Plant, & Water Treatment Facilities, Construction.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Carpenter & Pile Driver Local 200

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Carpenter	5/7/2025	5/7/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Carpenter	$35.94		$8.85	$10.78	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$59.69	$77.66
Pile Driver	$35.69		$8.85	$10.78	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$59.44	$77.29
Apprentice	BHR	Percent										
1st 6 months	$25.16	$70.00	$8.85	$2.00	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$40.13	$52.71
2nd 6 months	$25.16	$70.00	$8.85	$2.00	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$40.13	$52.71
3rd 6 months	$28.75	$80.00	$8.85	$8.62	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$50.34	$64.72
4th 6 months	$28.75	$80.00	$8.85	$8.62	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$50.34	$64.72
5th 6 months	$32.35	$90.00	$8.85	$9.70	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$55.02	$71.19
6th 6 months	$32.35	$90.00	$8.85	$9.70	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$55.02	$71.19
7th 6 months	$34.14	$95.00	$8.85	$10.24	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$57.35	$74.42
8th 6 months	$34.14	$95.00	$8.85	$10.24	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$57.35	$74.42

(*)Special Calculation Note :

Other is UBC National Fund.

Ratio :

1 Journeyman to 1 Apprentice Thereafter 2 Journeyman to 1 Apprentice The first carpenter on the job shall be a journeyman. The second carpenter employed may be an apprentice carpenter. After one (1) journeyman and one (1) apprentice are employed, each employer shall employ a ratio of one (1) apprentice, when avilable, to two (2) journeyman.

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Franklin, Guernsey, Licking, Madison, Marion, Muskingum, Morgan, Noble, Perry, Pickaway, Union

Special Jurisdictional Note :

Details :

CARPENTERS duties shall include but not limited to the milling, fashioning, joining, assembling, erecting, fastening, or dismantling of scaffolding and of material of wood, plastic, metal, fiber, cork and composition, and all other substitute materials. The handling, cleaning, erecting, installing and dismantling of machinery, equipment and all materials used by carpenters. The building and setting of all concrete forms and decking, and dismantling the same; the setting of templates for anchor bolts for structural members and for machinery, and the placing, leveling and bracing of these bolts; the making of all forms for bulkheads, figures, post, balusters and ornaments. The erection and installation of cooling towers assembled onsite. The building of all barricades and handling of rough lumber and drywall. The installation of all required blocking and all toilet accessories, including but not limited to grab bars, napkin dispensers and receptacles, mirrors and soap dispensers. The installation of metal studs and the welding of studs and other fastenings to receive material being applied by carpenters. The installation of all material used in drywall construction such as plasterboard, transite and other composition boards. The installation of carpet, artificial turf, wood and Resilient floors shall consist of and include the laying of all special designs of wood, wood block, wood composition, cork, linoleum, asphalt, mastic, plastic and rubber tile, whether nailed or laid in, or with linoleum paste or glue compositions. The installation of garage and overhead doors. The installation of fixtures, cabinets, shelving, racks, louvers, etc. The assembling and setting of all seats in theaters, halls, churches, schools, auditoriums, grandstands and other buildings. Our claim of jurisdiction, therefore, extends over the following subdivisions of the trade. Carpenters and Joiners; Bridge, Dock and Wharf Carpenters, Divers, Underpinners, Timbermen and Core Drillers; Shipwrights, Boat Builders, Ship Carpenters, Joiners and Caulkers, Cabinet Makers, Bench Hands, Stair Builders; Millmen; Wood and Resilient Floor Layers and Finishers; Carpet Layers; Shinglers; Siders; Insulators; Acoustic and Drywall Applicators; Shorers and House Movers; Loggers; Lumber and Sawmill Workers; Furniture Workers; Reed and Rattan Workers; Shingle Weavers; Casket and Coffin Makers; Box Makers; Railroad Carpenters; and Car Builders, regardless of material used; and all those engaged in the operation of woodworking or other machinery required in the fashioning, milling or manufacturing of products used in the trade, or engaged as helpers to any of the above divisions or subdivisions, and the handling, erecting and installing of material on any of the above divisions or subdivisions; burning welding, rigging and the use of any instrument or tool for layout work incidental to the trade. When the term “Carpenter” and “Joiner” is used, it shall mean all the subdivisions of the trade. PILEDRIVER: Where piling is used in the construction and repair of all wharves, docks, piers, trestles, caissons, cofferdams, the erection of all sea walls and breakwaters. The placing of all walling, bumper guards of wood or metal. The framing, boring, drilling or burning of all holes in the same, all tie and hog rods in connection with Piledrivers work. The driving, bracing, plumbing, cutting-off and capping of all piling whether wood, steel sheeting, metal pipe piling, composite or concrete. The heading and splicing of wood piling and the making of woodsheet piling, The welding, cutting or burning of any metal and wood piling and shoring and underpinning in connection with Piledriver work. The loading and unloading of all piling and other material used in connection with Piledrivers work. The loading, unloading, erecting, framing, dismantling, moving and handling of all drivers, derrick, cranes and other piledriving equipment used in the work. Drilling in piling or drilled in caissons where a steel liner is used. All machinery used for handling spuds or anchors on floating equipment used in our work shall be operated by our members. Where swing lines or derricks are used, members shall be used as watchmen. All underwater and marine work on all bulkheads, wharves, docks, shipyards, caissons, piers, bridges, pipeline work, viaducts, marine cable and trestles, as well as salvage and reclamation work where divers are employed. All clamming work that is done by floating derricks.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Carpenter & Piledriver SC District HevHwy

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCR01-2025ib	Carpenter	7/9/2025	7/9/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Journeyman	$35.69		$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$59.09	$76.94
Apprentice	BHR	Percent										
1st 6 months	$24.98	$70.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$48.38	$60.87
2nd 6 months	$24.98	$70.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$48.38	$60.87
3rd 6 months	$28.55	$80.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$51.95	$66.23
4th 6 months	$28.55	$80.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$51.95	$66.23
5th 6 months	$32.12	$90.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$55.52	$71.58
6th 6 months	$32.12	$90.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$55.52	$71.58
7th 6 months	$33.91	$95.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$57.31	$74.26
8th 6 months	$33.91	$95.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$57.31	$74.26

(*)Special Calculation Note :

Other: UBC National Fund

When the contractor furnishes the necessary underwater gear for the diver, the diver shall be paid one and one half (1 & 1/2) times the journeyman rate for the time spent in the water.

Ratio :

1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Athens, Delaware, Fairfield, Fayette, Franklin, Gallia, Guernsey, Highland, Hocking, Jackson, Lawrence, Licking, Madison, Marion, Meigs, Morgan, Muskingum, Noble, Perry, Pickaway, Pike, Ross, Scioto, Union, Vinton, Washington

Special Jurisdictional Note :

Details :

**Highway Construction, Airport Construction, Heavy Construction but not limited to: Tunnels, subways, drainage projects, flood control, reservoirs

Railroad Construction, Sewer Waterworks & Utility Construction but not limited to: storm sewers, waterlines, gas lines

Industrial & Building site, Power Plant, Amusement Park, Athletic stadium site, Sewer and Water Plants.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Carpenter Millwright Local 1090 Columbus

Type of Rate: Commercial

Change #:
LCN01-2025ib

Craft:
Carpenter

Effective Date:
5/13/2025

Effective Date:
5/13/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Carpenter Millwright	$35.59		$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$63.49	$81.29
Apprentice	BHR	Percent										
1st 6 months	$24.91	$70.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$52.81	$65.27
2nd 6 months	$24.91	$70.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$52.81	$65.27
3rd 6 months	$28.47	$80.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$56.37	$70.61
4th 6 months	$28.47	$80.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$56.37	$70.61
5th 6 months	$32.03	$90.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$59.93	$75.95
6th 6 months	$32.03	$90.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$59.93	$75.95
7th 6 months	$33.81	$95.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$61.71	$78.62
8th 6 months	$33.81	$95.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$61.71	$78.62

(*)Special Calculation Note :

Other is for UBC National Fund.

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Franklin, Guernsey, Licking, Madison, Marion, Morgan, Muskingum, Noble, Perry, Pickaway, Union

Special Jurisdictional Note :

Details :

The term “Millwright and Machine Erectors”’ jurisdiction shall mean the unloading, hoisting, rigging, skidding, moving, dismantling, aligning, erecting, assembling, repairing, maintenance and adjusting of all structures, processing areas either under cover, underground or elsewhere, required to process material, handle, manufacture or service, be it powered or receiving power manually, by steam, gas, electricity, gasoline, diesel, nuclear, solar, water, air or chemically, and in industries such as and including, which are identified for the purpose of description, but not limited to, the following: woodworking plants; canning industries; steel mills; coffee roasting plants; paper and pulp; cellophane; stone crushing; gravel and sand washing and handling; refineries; grain storage and handling; asphalt plants; sewage disposal; water plants; laundries; bakeries; mixing plants; can, bottle and bag packing plants; textile mills; paint mills; breweries; milk processing plants; power plants; aluminum processing or manufacturing plants; and amusement and entertainment fields. The installation of mechanical equipment in atomic energy plants; installation of reactors in power plants; installation of control rods and equipment in reactors; and installation of mechanical equipment in rocket missile bases, launchers, launching gantry, floating bases, hydraulic escape doors and any and all component parts thereto, either assembled, semi-assembled or disassembled. The installation of, but not limited to, the following: setting-up of all engines, motors, generators, air compressors, fans, pumps, scales, hoppers, conveyors of all types, sizes and their supports; escalators; man lifts; moving sidewalks; hosts; dumb waiters; all types of feeding machinery; amusement devices; mechanical pin setters and spotters in bowling alleys; refrigeration equipment; and the installation of all types of equipment necessary and required to process material either in the manufacturing or servicing. The handling and installation of pulleys, gears, sheaves, fly wheels, air and vacuum drives, worm drives and gear drivers directly or indirectly coupled to motors, belts, chains, screws, legs, boots, guards, booth tanks, all bin valves, turn heads and indicators, shafting, bearings, cable sprockets cutting all key seats in new and old work, troughs, chippers, filters, calendars, rolls, winders, rewinders, slitters, cutters, wrapping machines, blowers, forging machines, rams, hydraulic or otherwise, planning, extruder, ball, dust collectors, equipment in meat packing plants, splicing or ropes and cables. The laying-out, fabrication and installation of protection equipment including machinery guards, making and setting of templates for machinery, fabrication of bolts, nuts, pans, dripping of holes for any equipment which the Millwrights install regardless of materials; all welding and burning regardless of type, fabrication of all lines, hose or tubing used in lubricating machinery installed by Millwrights; grinding, cleaning, servicing and any machine work necessary for any part of any equipment installed by the Millwrights; and the break-in and trail run of any equipment or machinery installed by the Millwrights. It is agreed the Millwrights shall use the layout tools and optic equipment necessary to perform their work.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Cement Mason Local 132 (Columbus)

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Cement Mason	6/4/2025	6/4/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Cement Mason	$35.12		$8.90	$4.65	$0.75	$0.00	$3.10	$0.06	$0.00	$0.00	$52.58	$70.14
Apprentice	BHR	Percent										
1st Year	$24.58	$70.00	$8.90	$4.65	$0.75	$0.00	$3.10	$0.06	$0.00	$0.00	$42.04	$54.34
2nd Year	$28.10	$80.00	$8.90	$4.65	$0.75	$0.00	$3.10	$0.06	$0.00	$0.00	$45.56	$59.60
3rd Year	$31.61	$90.00	$8.90	$4.65	$0.75	$0.00	$3.10	$0.06	$0.00	$0.00	$49.07	$64.87

(*)Special Calculation Note :

Other: International Training Fund

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Ashland, Coshocton, Crawford, Delaware, Fairfield, Fayette, Franklin, Guernsey, Hocking, Knox, Licking, Madison, Marion, Morrow, Muskingum, Perry, Pickaway, Richland, Ross, Union, Vinton, Wyandot

Special Jurisdictional Note :

Details :

Working on swing stage, slip scaffold, window jack scaffold, scissor lifts, and aerial lifts shall receive the following rates: $.50 above the regular rate for heights up to fifty (50) feet above grade level $1.00 above the regular rate for heights over fifty (50) feet above grade level

Prevailing Wage Rate
Skilled Crafts

Name of Union: Cement Mason Local 132 Hev Hwy (Columbus)

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Cement Mason	5/1/2025	5/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Cement Mason	$37.29		$9.00	$7.65	$0.75	$0.00	$2.40	$0.07	$0.00	$0.00	$57.16	$75.81
Apprentice	BHR	Percent										
1st Year	$26.10	$70.00	$9.00	$7.65	$0.75	$0.00	$2.40	$0.07	$0.00	$0.00	$45.97	$59.02
2nd Year	$29.83	$80.00	$9.00	$7.65	$0.75	$0.00	$2.40	$0.07	$0.00	$0.00	$49.70	$64.62
3rd Year	$33.56	$90.00	$9.00	$7.65	$0.75	$0.00	$2.40	$0.07	$0.00	$0.00	$53.43	$70.21

(*)Special Calculation Note :

Other: International Training Fund

Ratio :

1 Journeyman to 1 Apprentice 2 Journeymen to 1 Apprentice thereafter

Jurisdiction (* denotes special jurisdictional note) :

Ashland, Athens, Coshocton, Crawford, Delaware, Fairfield, Fayette, Franklin, Guernsey, Hocking, Knox, Licking, Madison, Marion, Meigs, Monroe, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Richland, Ross, Union, Vinton, Washington, Wyandot

Special Jurisdictional Note :

Details :

Highway Construction, Sewer, Waterworks And Utility Construction, Industrial & Building Site, Heavy Construction, Airport Construction Or Railroad Construction Work, Power Plant, Tunnels, Amusement Park, Athletic Stadium Site Work, Pollution Control, Sewer Plant, Waste & Water Plant, Water Treatment Facilities Construction.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 683 Inside

Type of Rate: Commercial

Change #: LCN02-2025ib

Craft: Electrical

Effective Date: 8/13/2025

Effective Date: 8/13/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrician	$43.00		$12.15	$8.81	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$69.37	$90.87
Welding	$44.00		$12.15	$8.84	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$70.40	$92.40
Medium Voltage Splicing	$44.00		$12.15	$8.84	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$70.40	$92.40
Over 100 feet	$64.50		$12.15	$9.46	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$91.52	$123.7
Level 1 CW 0 to 2000 hours	$15.29		$6.83	$0.46	$0.92	$0.00	$0.46	$0.10	$0.00	$0.00	$24.06	$31.71
Level 2 CW 2001 to 4000 hours	$16.25		$6.83	$0.49	$0.92	$0.00	$0.49	$0.10	$0.00	$0.00	$25.08	$33.21
Level 3 CW 4001 to 6000 hours	$17.20		$6.83	$0.52	$0.92	$0.00	$0.52	$0.10	$0.00	$0.00	$26.09	$34.69
Level 4 CW 6001 to 8000 hours	$19.12		$6.83	$0.57	$0.92	$0.00	$0.57	$0.10	$0.00	$0.00	$28.11	$37.67
Level 1 CE 8001 to 10000 hours	$21.03		$6.83	$0.63	$0.92	$0.00	$0.63	$0.10	$0.00	$0.00	$30.14	$40.66
Level 2 CE 10,001 to 12,000 hours	$22.94		$6.83	$0.69	$0.92	$0.00	$0.69	$0.10	$0.00	$0.00	$32.17	$43.64
Level 3 CE 12,001 to14,000 hours	$28.67		$6.83	$0.86	$0.92	$0.00	$0.86	$0.10	$0.00	$0.00	$38.24	$52.58
Apprentice	BHR	Percent										
0-1000 hrs 1st Period	$21.50	$50.00	$12.15	$4.41	$1.16	$0.00	$0.00	$0.00	$0.00	$0.00	$39.22	$49.97
1001-2000 hrs 2nd Period	$23.65	$55.00	$12.15	$4.85	$1.16	$0.00	$0.00	$0.00	$0.00	$0.00	$41.81	$53.63
2001-3500 hrs 3rd Period	$25.80	$60.00	$12.15	$5.28	$1.16	$0.00	$2.55	$0.00	$0.00	$0.00	$46.94	$59.84
3501-5000 hrs 4th Period	$27.95	$65.00	$12.15	$5.73	$1.16	$0.00	$2.76	$0.00	$0.00	$0.00	$49.75	$63.73
5001-6500 hrs 5th Period	$30.10	$70.00	$12.15	$6.16	$1.16	$0.00	$2.98	$0.00	$0.00	$0.00	$52.55	$67.60

6501-8000 hrs 6th Period	$34.40	$80.00	$12.15	$7.05	$1.16	$0.00	$3.40	$0.00	$0.00	$0.00	$58.16	$75.36

(*)Special Calculation Note :

Other for CW/CE: Education Fund

Ratio :

1 to 3 Journeymen to 2 Apprentices
4 to 6 Journeymen to 4 Apprentices

Construction Wireman and Construction Electrician Ratio:
1 Journeymen to 4 (CW/CE) Employees
An Inside Journeyman Wireman is required on the project at the 5th worker or when apprentices are used.

Jurisdiction (* denotes special jurisdictional note) :

Champaign, Clark, Delaware, Fairfield, Franklin, Madison, Pickaway*, Union

Special Jurisdictional Note :

In Pickaway County the following townships: Circleville, Darby, Harrison, Jackson, Madison, Monroe, Muhlenberg, Scioto, Walnut, Washington.

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 683 Inside Lt Commercial South West

Type of Rate: Commercial

Change #: LCN02-2025ib

Craft: Electrical

Effective Date: 8/13/2025

Effective Date: 8/13/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrician	$43.00		$12.15	$8.81	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$69.37	$90.87
Welding	$44.00		$12.15	$8.84	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$70.40	$92.40
Medium Voltage Splicing	$44.00		$12.15	$8.84	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$70.40	$92.40
Over 100 feet	$64.50		$12.15	$9.46	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$91.52	$123.7
Level 1 CW 0 to 2000 hours	$15.29		$6.83	$0.46	$0.92	$0.00	$0.46	$0.10	$0.00	$0.00	$24.06	$31.71
Level 2 CW 2001 to 4000 hours	$16.25		$6.83	$0.49	$0.92	$0.00	$0.49	$0.10	$0.00	$0.00	$25.08	$33.21
Level 3 CW 4001 to 6000 hours	$17.20		$6.83	$0.52	$0.92	$0.00	$0.52	$0.10	$0.00	$0.00	$26.09	$34.69
Level 4 CW 6001 to 8000 hours	$19.12		$6.83	$0.57	$0.92	$0.00	$0.57	$0.10	$0.00	$0.00	$28.11	$37.67
Level 1 CE 8001 to 10000 hours	$21.03		$6.83	$0.63	$0.92	$0.00	$0.63	$0.10	$0.00	$0.00	$30.14	$40.66
Level 2 CE 10,001 to 12,000 hours	$22.94		$6.83	$0.69	$0.92	$0.00	$0.69	$0.10	$0.00	$0.00	$32.17	$43.64
Level 3 CE 12,001 to14,000 hours	$28.67		$6.83	$0.86	$0.92	$0.00	$0.86	$0.10	$0.00	$0.00	$38.24	$52.58
Apprentice	BHR	Percent										
0-1000 hrs 1st Period	$21.50	$50.00	$12.15	$4.41	$1.16	$0.00	$0.00	$0.00	$0.00	$0.00	$39.22	$49.97
1001-2000 hrs 2nd Period	$23.65	$55.00	$12.15	$4.85	$1.16	$0.00	$0.00	$0.00	$0.00	$0.00	$41.81	$53.63
2001-3500 hrs 3rd Period	$25.80	$60.00	$12.15	$5.28	$1.16	$0.00	$2.55	$0.00	$0.00	$0.00	$46.94	$59.84
3501-5000 hrs 4th Period	$27.95	$65.00	$12.15	$5.73	$1.16	$0.00	$2.76	$0.00	$0.00	$0.00	$49.75	$63.73
5001-6500 hrs 5th Period	$30.10	$70.00	$12.15	$6.16	$1.16	$0.00	$2.98	$0.00	$0.00	$0.00	$52.55	$67.60

6501-8000 hrs 6th Period	$34.40	$80.00	$12.15	$7.05	$1.16	$0.00	$3.40	$0.00	$0.00	$0.00	$58.16	$75.36

(*)Special Calculation Note :

Other for CW/CE: Education Fund

Ratio :

1 to 3 Journeymen to 2 Apprentices
4 to 6 Journeymen to 4 Apprentices

Construction Wireman and Construction Electrician Ratio:
1 Journeymen to 4 (CW/CE) Employees
An Inside Journeyman Wireman is required on the project at the 5th worker or when apprentices are used.

Jurisdiction (* denotes special jurisdictional note) :

Champaign, Clark, Delaware, Fairfield, Franklin, Madison, Pickaway*, Union

Special Jurisdictional Note :

In Pickaway County the following townships: Circleville, Darby, Harrison, Jackson, Madison, Monroe, Muhlenberg, Scioto, Walnut, Washington.

Details :

The scope of work for the light commercial agreement shall apply to the following facilities not to exceed 200,000 square feet; office buildings, shopping centers, auto sales agencies and garages, churches, funeral homes, nursing homes, hotels, retail and wholesale facilities, small stand-alone manufacturing facilities when free standing and not part of a larger facility (not to exceed 50,000 square fee), solar projects (500 panels or less) unless otherwise covered under the agreement, lighting retrofits (when not associated with remodels involving branch re-circuiting) lighting retrofits shall be defined as the changing of lamps and ballasts in existing light fixtures and shall also include the one for one replacement of existing fixtures, warehouses, gas stations, food service centers, restaurants, entertainment facilities, hospitals, clinics, motels, residential buildings.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 683 Voice Data Video

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Electrical	8/13/2025	8/13/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrical Installer Technician B	$32.00		$10.62	$4.46	$0.80	$0.00	$3.00	$0.74	$0.00	$0.00	$51.62	$67.62
Installer Technician A	$33.50		$10.62	$4.51	$0.80	$0.00	$3.00	$0.77	$0.00	$0.00	$53.20	$69.95
Cable Puller	$16.00		$10.62	$0.48	$0.80	$0.00	$3.00	$0.37	$0.00	$0.00	$31.27	$39.27
Apprentice	BHR	Percent										
1st Period 0 - 1000 hours	$19.20	$60.00	$10.62	$4.08	$0.80	$0.00	$3.00	$0.44	$0.00	$0.00	$38.14	$47.74
2nd Period 1001 - 2000 hours	$20.80	$65.00	$10.62	$4.12	$0.80	$0.00	$3.00	$0.48	$0.00	$0.00	$39.82	$50.22
3rd Period 2001 - 3000 hours	$22.40	$70.00	$10.62	$4.17	$0.80	$0.00	$3.00	$0.52	$0.00	$0.00	$41.51	$52.71
4th Period 3001 - 4000 hours	$24.00	$75.00	$10.62	$4.22	$0.80	$0.00	$3.00	$0.55	$0.00	$0.00	$43.19	$55.19
5th Period 4001 - 5000 hours	$25.60	$80.00	$10.62	$4.27	$0.80	$0.00	$3.00	$0.59	$0.00	$0.00	$44.88	$57.68
6th Period 5001 - 6000 hours	$27.20	$85.00	$10.62	$4.32	$0.80	$0.00	$3.00	$0.63	$0.00	$0.00	$46.57	$60.17

(*)Special Calculation Note :

Other is Holiday Pay

Ratio :

1 Apprentice for every 1 Installer Technician
Cable Pullers can only be employed after an apprentice is employed on the job

Jurisdiction (* denotes special jurisdictional note) :

Champaign, Clark, Delaware, Fairfield, Franklin, Madison, Pickaway*, Union

Special Jurisdictional Note :

In Pickaway County the following townships: Circleville, Darby, Harrison, Jackson, Madison, Monroe, Muhlenberg, Scioto, Walnut, Washington.

Details :

An employee who is required to wear an electronic device after hours will receive an additional 1.00 per hour for all hours worked.

HOLIDAYS: Memorial Day, 4th of July, Labor Day, Thanksgiving Day, Christmas Day, New Years Day.

The following work is EXCLUDED from the Teledata Technician work scope: - Installation of computer systems in industrial applications such as assembly lines, robotics, computer controller manufacturing systems. - Installation of conduit &/or raceways shall be installed by Inside Wireman . On sites where there is no Inside Wireman employed, the Teledata Technician may install raceway, or conduit not greater than 10 foot. - Fire Alarm work is excluded on all new construction sites or wherever the fire alarm system is installed in conduit - All HVAC control work. TECHNICIAN (A) is a Technician B who holds a current Technician Certification from BICSI (Building Industry Consulting Service International, Inc.)

CABLE PULLERS are for the installation of cable from one termination point to another.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 71 High Tension Pipe Type Cable

Type of Rate: Commercial

Change #: LCN02-2024ib

Craft: Electrical

Effective Date: 1/6/2025

Effective Date: 1/6/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrical Lineman	$52.94		$7.50	$1.59	$0.53	$0.00	$12.71	$0.75	$0.00	$0.00	$76.02	$102.4
Certified Lineman Welder	$52.94		$7.50	$1.59	$0.53	$0.00	$12.71	$0.75	$0.00	$0.00	$76.02	$102.49
Certified Cable Splicer	$52.94		$7.50	$1.59	$0.53	$0.00	$12.71	$0.75	$0.00	$0.00	$76.02	$102.49
Operator A	$47.43		$7.50	$1.42	$0.47	$0.00	$11.38	$0.75	$0.00	$0.00	$68.95	$92.67
Operator B	$41.99		$7.50	$1.26	$0.42	$0.00	$10.08	$0.75	$0.00	$0.00	$62.00	$83.00
Operator C	$33.74		$7.50	$1.01	$0.34	$0.00	$8.10	$0.75	$0.00	$0.00	$51.44	$68.31
Groundman 0-12 months Exp	$26.47		$7.50	$0.79	$0.26	$0.00	$6.35	$0.75	$0.00	$0.00	$42.12	$55.36
Groundman 0-12 months Exp w/CDL	$29.12		$7.50	$0.87	$0.29	$0.00	$6.99	$0.75	$0.00	$0.00	$45.52	$60.08
Groundman 1 yr or more	$29.12		$7.50	$0.87	$0.29	$0.00	$6.99	$0.75	$0.00	$0.00	$45.52	$60.08
Groundman 1 yr or more w/CDL	$34.41		$7.50	$1.03	$0.34	$0.00	$8.26	$0.75	$0.00	$0.00	$52.29	$69.50
Equipment Mechanic A	$41.99		$7.50	$1.26	$0.42	$0.00	$10.08	$0.75	$0.00	$0.00	$62.00	$83.00
Equipment Mechanic B	$37.86		$7.50	$1.14	$0.38	$0.00	$9.09	$0.75	$0.00	$0.00	$56.72	$75.65
Equipment Mechanic C	$33.74		$7.50	$1.01	$0.34	$0.00	$8.10	$0.75	$0.00	$0.00	$51.44	$68.31
X-Ray Technician	$52.94		$7.50	$1.59	$0.53	$0.00	$12.71	$0.75	$0.00	$0.00	$76.02	$102.49
Apprentice	BHR	Percent										
1st 1000 hrs	$31.76	$60.00	$7.50	$0.95	$0.32	$0.00	$7.62	$0.75	$0.00	$0.00	$48.90	$64.79
2nd 1000 hrs	$34.41	$65.00	$7.50	$1.03	$0.34	$0.00	$8.26	$0.75	$0.00	$0.00	$52.29	$69.50
3rd 1000 hrs	$37.06	$70.00	$7.50	$1.11	$0.37	$0.00	$8.89	$0.75	$0.00	$0.00	$55.68	$74.21

4th 1000 hrs	$39.71	$75.00	$7.50	$1.19	$0.40	$0.00	$9.53	$0.75	$0.00	$0.00	$59.08	$78.93
5th 1000 hrs	$42.35	$80.00	$7.50	$1.27	$0.42	$0.00	$10.16	$0.75	$0.00	$0.00	$62.45	$83.63
6th 1000 hrs	$45.00	$85.00	$7.50	$1.35	$0.45	$0.00	$10.80	$0.75	$0.00	$0.00	$65.85	$88.35
7th 1000 hrs	$47.65	$90.00	$7.50	$1.43	$0.48	$0.00	$11.44	$0.75	$0.00	$0.00	$69.25	$93.07

(*)Special Calculation Note :

Other is Health Retirement Account Operator "A" John Henry Rock Drill, D-6 (or equivalent) and above, Trackhoe Digger, (320 Track excavator), Cranes (greater then 25 tons and less than 45 tons). Operator "B" Cranes (greater than 6 tons and up to 25 tons), Backhoes, Road Tractor, Dozer up to D-5, Pressure Digger- wheeled or tracked, all Tension wire Stringing equipment. Operator "C" Trench, Backhoe, Riding type vibratory Compactor, Ground Rod Driver, Boom Truck (6 ton & below), Skid Steer Loaders, Material Handler. *All Operators of cranes 45 ton or larger shall be paid the journeyman rate of pay. $0.30 is for Health Retirement Account.

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Delaware, Fairfield, Fayette, Franklin, Gallia, Geauga, Greene, Guernsey, Hamilton, Harrison, Highland, Hocking, Holmes, Jackson, Jefferson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Pike, Portage, Preble, Richland, Ross, Scioto, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Vinton, Warren, Washington, Wayne

Special Jurisdictional Note :

Details :

Heli - Arc Welding will be paid $.30 above Journeyman rate. Additional compensation of 10% over the Journeyman Lineman and Journeyman Technician for performing work on structures outside of buildings such as water towers, smoke stacks, radio and television towers, more than 75' above the ground.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 71 Outside (Central OH Chapter)

Type of Rate: Commercial

Change #: LCN01-2025ib

Craft: Electrical

Effective Date: 6/4/2025

Effective Date: 6/4/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrical Lineman	$46.03		$7.50	$1.38	$0.46	$0.00	$9.20	$0.50	$0.00	$0.00	$65.07	$88.09
Traffic Signal & Lighting Journeyman	$44.43		$7.50	$1.33	$0.44	$0.00	$8.89	$0.50	$0.00	$0.00	$63.09	$85.31
Equipment Operator	$40.44		$7.50	$1.21	$0.40	$0.00	$8.09	$0.50	$0.00	$0.00	$58.14	$78.36
Groundman 0-12 months (W/O CDL)	$24.52		$7.50	$0.74	$0.25	$0.00	$4.90	$0.50	$0.00	$0.00	$38.41	$50.67
Groundman 0-12 Months W/CDL	$26.78		$7.50	$0.80	$0.27	$0.00	$5.36	$0.50	$0.00	$0.00	$41.21	$54.60
Groundman greater than 1 Year W/CDL	$29.07		$7.50	$0.87	$0.29	$0.00	$5.81	$0.50	$0.00	$0.00	$44.04	$58.58
Traffic Signal Apprentices	$		$	$	$	$	$	$	$	$	$	$
1st 1,000 hours	$26.66		$7.50	$0.80	$0.27	$0.00	$5.33	$0.50	$0.00	$0.00	$41.06	$54.39
2nd 1,000 hours	$28.88		$7.50	$0.87	$0.29	$0.00	$5.78	$0.50	$0.00	$0.00	$43.82	$58.26
3rd 1,000 hours	$31.10		$7.50	$0.93	$0.31	$0.00	$6.22	$0.50	$0.00	$0.00	$46.56	$62.11
4th 1,000 hours	$33.32		$7.50	$1.00	$0.33	$0.00	$6.66	$0.50	$0.00	$0.00	$49.31	$65.97
5th 1,000 hours	$35.54		$7.50	$1.07	$0.36	$0.00	$7.11	$0.50	$0.00	$0.00	$52.08	$69.85
6th 1,000 hours	$39.99		$7.50	$1.20	$0.40	$0.00	$8.00	$0.50	$0.00	$0.00	$57.59	$77.59
Apprentice	BHR	Percent										
1st 1,000 Hours	$27.62	$60.00	$7.50	$0.83	$0.28	$0.00	$5.52	$0.50	$0.00	$0.00	$42.25	$56.06
2nd 1,000 Hours	$29.92	$65.00	$7.50	$0.90	$0.30	$0.00	$5.98	$0.50	$0.00	$0.00	$45.10	$60.06
3rd 1,000 Hours	$32.22	$70.00	$7.50	$0.97	$0.32	$0.00	$6.44	$0.50	$0.00	$0.00	$47.95	$64.06
4th 1,000 Hours	$34.52	$75.00	$7.50	$1.04	$0.35	$0.00	$6.90	$0.50	$0.00	$0.00	$50.81	$68.07

5th 1,000 Hours	$36.82	$80.00	$7.50	$1.10	$0.37	$0.00	$7.36	$0.50	$0.00	$0.00	$53.65	$72.07
6th 1,000 Hours	$39.13	$85.00	$7.50	$1.17	$0.39	$0.00	$7.82	$0.50	$0.00	$0.00	$56.51	$76.07
7th 1,000 Hours	$41.43	$90.00	$7.50	$1.24	$0.41	$0.00	$8.28	$0.50	$0.00	$0.00	$59.36	$80.07

(*)Special Calculation Note :

Other is Health Reimburstment Account

Ratio :

1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Ashland, Athens, Coshocton, Crawford, Delaware, Fairfield, Fayette, Franklin, Gallia, Guernsey, Highland, Hocking, Jackson, Knox, Lawrence, Licking, Madison, Marion, Meigs, Monroe, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Pike, Richland, Ross, Scioto, Tuscarawas, Union, Vinton, Washington

Special Jurisdictional Note :

Details :

A groundman when directed shall assist a Journeyman Lineman, Traffic Signal and Lighting Journeyman or Equipment Operator in the performance of his/her work on the ground, including the use of hand tools. Under no circumstances shall this classification climb poles, towers, or work from an elevated platform or bucket truck. This classification shall not perform work normally assigned to an Apprentice. No more than three (3) Groundmen shall work alone. Jobs with more that three Groundmen shall be supervised by a Groundcrew Foreman, Journeyman Lineman, Journeyman Traffic Signal Technician or an Equipment Operator. Scope of Work: installation and maintenance of highway and street lighting, highway and street sign lighting, electronic message boards and traffic control systems, camera systems, traffic signal work, substation and line construction including overhead and underground projects for private and industrial work as in accordance with the IBEW Constitution. This Agreement includes the operation of all tools and equipment necessary for the installation of the above projects.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 71 Outside Utility Power

Type of Rate: Commercial

Change #: LCN01-2024ib

Craft: Electrical

Effective Date: 1/6/2025

Effective Date: 1/6/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrical Lineman	$50.15		$7.50	$1.50	$0.50	$0.00	$12.04	$0.75	$0.00	$0.00	$72.44	$97.52
Substation Technician	$50.15		$7.50	$1.50	$0.50	$0.00	$12.04	$0.75	$0.00	$0.00	$72.44	$97.52
Cable Splicer	$52.52		$7.50	$1.58	$0.52	$0.00	$12.60	$0.75	$0.00	$0.00	$75.47	$101.7
Operator A	$44.95		$7.50	$1.35	$0.45	$0.00	$10.79	$0.75	$0.00	$0.00	$65.79	$88.27
Operator B	$39.73		$7.50	$1.19	$0.40	$0.00	$9.53	$0.75	$0.00	$0.00	$59.10	$78.97
Operator C	$31.89		$7.50	$0.96	$0.32	$0.00	$7.65	$0.75	$0.00	$0.00	$49.07	$65.02
Groundman 0-12 months Exp	$25.07		$7.50	$0.75	$0.25	$0.00	$6.02	$0.75	$0.00	$0.00	$40.34	$52.88
Groundman 0-12 months Exp w/CDL	$27.58		$7.50	$0.83	$0.28	$0.00	$6.62	$0.75	$0.00	$0.00	$43.56	$57.35
Groundman 1 yr or more	$27.58		$7.50	$0.83	$0.28	$0.00	$6.62	$0.75	$0.00	$0.00	$43.56	$57.35
Groundman 1 yr or more w/CDL	$32.60		$7.50	$0.98	$0.33	$0.00	$7.82	$0.75	$0.00	$0.00	$49.98	$66.28
Equipment Mechanic A	$39.73		$7.50	$1.19	$0.40	$0.00	$9.54	$0.75	$0.00	$0.00	$59.11	$78.98
Equipment Mechanic B	$35.82		$7.50	$1.07	$0.36	$0.00	$8.60	$0.75	$0.00	$0.00	$54.10	$72.01
Equipment Mechanic C	$31.89		$7.50	$0.96	$0.32	$0.00	$7.65	$0.75	$0.00	$0.00	$49.07	$65.02
Line Truck w/uuger	$35.16		$7.50	$1.05	$0.35	$0.00	$8.44	$0.75	$0.00	$0.00	$53.25	$70.83
Apprentice	BHR	Percent										
1st 1000 hrs	$30.09	$60.00	$7.50	$0.90	$0.30	$0.00	$7.22	$0.75	$0.00	$0.00	$46.76	$61.81
2nd 1000 hrs	$32.60	$65.00	$7.50	$0.98	$0.33	$0.00	$7.82	$0.75	$0.00	$0.00	$49.98	$66.28
3rd 1000 hrs	$35.11	$70.00	$7.50	$1.05	$0.35	$0.00	$8.43	$0.75	$0.00	$0.00	$53.19	$70.74

4th 1000 hrs	$37.61	$75.00	$7.50	$1.13	$0.38	$0.00	$9.03	$0.75	$0.00	$0.00	$56.40	$75.21
5th 1000 hrs	$40.12	$80.00	$7.50	$1.20	$0.40	$0.00	$9.63	$0.75	$0.00	$0.00	$59.60	$79.66
6th 1000 hrs	$42.63	$85.00	$7.50	$1.28	$0.43	$0.00	$10.23	$0.75	$0.00	$0.00	$62.82	$84.13
7th 1000 hrs	$45.14	$90.00	$7.50	$1.35	$0.45	$0.00	$10.83	$0.75	$0.00	$0.00	$66.02	$88.58

(*)Special Calculation Note :

Other is Health Reimburstment Account Operator "A" John Henry Rock Drill, D-6 (or equivalent) and above, Trackhoe Digger, (320 Track excavator), Cranes (greater then 25 tons and less than 45 tons). Operator "B" Cranes (greater than 6 tons and up to 25 tons), Backhoes, Road Tractor, Dozer up to D-5, Pressure Digger- wheeled or tracked, all Tension wire Stringing equipment. Operator "C" Trench, Backhoe, Riding type vibratory Compactor, Ground Rod Driver, Boom Truck (6 ton & below), Skid Steer Loaders, Material Handler.

Ratio :

(1) Journeyman Lineman to (1) Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Delaware, Fairfield, Fayette, Franklin, Gallia, Geauga, Greene, Guernsey, Hamilton, Harrison, Highland, Hocking, Holmes, Jackson, Jefferson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Pike, Portage, Preble, Richland, Ross, Scioto, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Vinton, Warren, Washington, Wayne

Special Jurisdictional Note :

Details :

Heli - Arc Welding will be paid $.30 above Journeyman rate. Additional compensation of 10% over the Journeyman Lineman and Journeyman Technician for performing work on structures outside of buildings such as water towers, smoke stacks, radio and television towers, more than 75' above the ground.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 71 Underground Residential Distribution

Type of Rate: Commercial

Change #: LCN02-2024ib

Craft: Electrical

Effective Date: 1/6/2025

Effective Date: 1/6/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
URD Electrican	$38.05		$7.50	$1.14	$0.38	$0.00	$9.13	$0.75	$0.00	$0.00	$56.95	$75.98
Equipment Operator A	$34.04		$7.50	$1.02	$0.34	$0.00	$8.17	$0.75	$0.00	$0.00	$51.82	$68.84
Equipment Operator B	$31.26		$7.50	$0.94	$0.31	$0.00	$7.50	$0.75	$0.00	$0.00	$48.26	$63.89
Directional Drill Locator	$34.04		$7.50	$1.02	$0.34	$0.00	$8.17	$0.75	$0.00	$0.00	$51.82	$68.84
Directional Drill Operator	$31.26		$7.50	$0.94	$0.31	$0.00	$7.50	$0.75	$0.00	$0.00	$48.26	$63.89
Groundman 0-12 months Exp	$24.70		$7.50	$0.74	$0.25	$0.00	$5.93	$0.75	$0.00	$0.00	$39.87	$52.22
Groundman 0-12 months Exp w/CDL	$27.24		$7.50	$0.82	$0.27	$0.00	$6.54	$0.75	$0.00	$0.00	$43.12	$56.74
Groundman 1 yr or more	$27.24		$7.50	$0.82	$0.27	$0.00	$6.54	$0.75	$0.00	$0.00	$43.12	$56.74
Groundman 1 yr or more w/CDL	$32.26		$7.50	$0.97	$0.32	$0.00	$7.74	$0.75	$0.00	$0.00	$49.54	$65.67
Apprentice	BHR	Percent										
1st 1000 hrs	$30.44	$80.00	$7.50	$0.91	$0.30	$0.00	$7.31	$0.75	$0.00	$0.00	$47.21	$62.43
2nd 1000 hrs	$32.34	$85.00	$7.50	$0.97	$0.32	$0.00	$7.76	$0.75	$0.00	$0.00	$49.64	$65.81
3rd 1000 hrs	$34.25	$90.00	$7.50	$1.03	$0.34	$0.00	$8.22	$0.75	$0.00	$0.00	$52.09	$69.21
4th 1000 hrs	$36.15	$95.00	$7.50	$1.08	$0.36	$0.00	$8.68	$0.75	$0.00	$0.00	$54.52	$72.59

(*)Special Calculation Note :

Other: Health Reimburstment Account

Ratio :

(1) Journeyman Lineman to (1) Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Delaware, Fairfield, Fayette, Franklin, Gallia, Geauga, Greene, Guernsey, Hamilton, Harrison, Highland, Hocking, Holmes, Jackson, Jefferson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Pike, Portage, Preble, Richland, Ross, Scioto, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Vinton, Warren, Washington, Wayne

Special Jurisdictional Note :

Details :

This work applies to projects designated for any outside Underground Residential Distribution construction work for electrical utilities, municipalities and rural electrification projects.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 71 Voice Data Video Outside

Type of Rate: Commercial

Change #: LCN02-2024ib

Craft: Electrical

Effective Date: 3/6/2024

Effective Date: 3/6/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrical Installer Technician I	$35.39		$7.25	$1.06	$0.00	$0.00	$1.77	$0.00	$0.00	$0.00	$45.47	$63.17
Installer Technician II	$33.37		$7.25	$1.00	$0.00	$0.00	$1.67	$0.00	$0.00	$0.00	$43.29	$59.98
Installer Repairman	$33.37		$7.25	$1.00	$0.00	$0.00	$1.67	$0.00	$0.00	$0.00	$43.29	$59.98
Equipment Operator II	$24.98		$7.25	$0.75	$0.00	$0.00	$1.25	$0.00	$0.00	$0.00	$34.23	$46.72
Cable Splicer	$35.39		$7.25	$1.06	$0.00	$0.00	$1.77	$0.00	$0.00	$0.00	$45.47	$63.17
Ground Driver W/CDL	$16.69		$7.25	$0.50	$0.00	$0.00	$0.83	$0.00	$0.00	$0.00	$25.27	$33.62
Groundman	$14.57		$7.25	$0.44	$0.00	$0.00	$0.73	$0.00	$0.00	$0.00	$22.99	$30.28
Apprentice	BHR	Percent										
Trainee F	$17.70	$50.01	$7.25	$0.53	$0.00	$0.89	$0.00	$0.00	$0.00	$0.00	$26.37	$35.22
Trainee E	$20.53	$58.00	$7.25	$0.62	$0.00	$1.03	$0.00	$0.00	$0.00	$0.00	$29.43	$39.69
Trainee D	$23.36	$66.00	$7.25	$0.70	$0.00	$1.17	$0.00	$0.00	$0.00	$0.00	$32.48	$44.16
Trainee C	$26.19	$74.00	$7.25	$0.79	$0.00	$1.31	$0.00	$0.00	$0.00	$0.00	$35.54	$48.63
Trainee B	$29.02	$82.00	$7.25	$0.87	$0.00	$1.45	$0.00	$0.00	$0.00	$0.00	$38.59	$53.10
Trainee A	$31.85	$90.00	$7.25	$0.96	$0.00	$1.59	$0.00	$0.00	$0.00	$0.00	$41.65	$57.58

(*)Special Calculation Note :

Ratio :

1Trainee to 1 Journeyman

Jurisdiction (* denotes special jurisdictional note) :

Adams, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Delaware, Fairfield, Fayette, Franklin, Gallia, Geauga, Greene, Guernsey, Hamilton, Harrison, Highland, Hocking, Holmes, Jackson, Jefferson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Pike, Portage, Preble, Richland, Ross, Scioto, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Vinton, Warren, Washington, Wayne

Special Jurisdictional Note :

Details :

Cable Splicer: Inspect and test lines or cables, analyze results, and evaluate transmission characteristics. Cover conductors with insulation or seal splices with moisture-proof covering. Install, splice, test, and repair cables using tools or mechanical equipment. This will include the splicing of fiber. Installer Technician I: Must know all aspects of telephone and cable work. This is to include aerial, underground, and manhole work. Must know how to climb and run bucket. Must have all the tools required to perform these tasks. Must be able to be responsible for the safety of the crew at all times. Must also have CDL license and have at least 5 years experience. Installer Repairman: Perform tasks of repairing, installing, and testing phone and CATV services. Installer Technician II: Have at least three years of telephone and CATV experience. Must have the knowledge of underground, aerial, and manhole work. Must be able to climb and operate bucket. Must have CDL. Must have all tools needed to perform these tasks. Equipment Operator II: Able to operate a digger derrick or bucket truck. Have at least 3 years of experience and must have a valid CDL license. Groundman W/CDL: Must have a valid CDL license and be able to perform tasks such as: climbing poles, pulling down guys, making up material, and getting appropriate tools for the job. Must have at least 5 year's experience. Groundman: Perform tasks such as: climbing poles, pulling down guys, making up material, and getting appropriate tools for the job. Experience 0-5 years.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Elevator Local 37

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2023ib	Elevator	1/1/2024	1/1/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Elevator Mechanic	$54.93		$16.17	$10.86	$0.75	$4.39	$10.10	$0.00	$0.00	$0.00	$97.20	$124.6
Helper	$38.45		$16.17	$10.86	$0.75	$3.07	$10.10	$0.00	$0.00	$0.00	$79.40	$98.63
Apprentice	BHR	Percent										
Probationary Apprentice	$27.47	$50.01	$0.00	$0.00	$0.00	$1.64	$0.00	$0.00	$0.00	$0.00	$29.11	$42.85
1st Year	$30.21	$55.00	$16.17	$10.86	$0.75	$1.81	$10.10	$0.00	$0.00	$0.00	$69.90	$85.01
2nd Year	$35.70	$65.00	$16.17	$10.86	$0.75	$2.14	$10.10	$0.00	$0.00	$0.00	$75.72	$93.58
3rd Year	$38.45	$70.00	$16.17	$10.86	$0.75	$2.30	$10.10	$0.00	$0.00	$0.00	$78.63	$97.86
4th Year	$43.94	$80.00	$16.17	$10.86	$0.75	$2.63	$10.10	$0.00	$0.00	$0.00	$84.45	$106.4
Assistant Mechanic	$43.94	$80.00	$16.17	$10.86	$0.75	$3.51	$10.10	$0.00	$0.00	$0.00	$85.33	$107.3

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice** 1 Journeyman to 1 Helper** 1 Journeyman to 1 Assistant Mechanic**

Jurisdiction (* denotes special jurisdictional note) :

Athens, Champaign, Clark, Delaware, Fairfield, Fayette, Franklin, Gallia, Guernsey, Hocking, Jackson, Knox, Lawrence, Licking, Logan, Madison, Marion, Meigs, Monroe*, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Pike, Ross, Union, Vinton

Special Jurisdictional Note :

Monroe County is shared by both Local 37 and Local 6.

Details :

**Art. 10 Par. 2 Apprentice Work Qualifications: Par 2- The total number of Helpers and Apprentices employed shall not exceed the number of Mechanics on any one job, except on jobs where two teams or more are working, one extra Helper or Apprentice may be employed for the first two teams and an extra Helper or Apprentice for each additional three teams. Further, the Company may use as many Helpers and Apprentices as best suits his convenience under the direction of a Mechanic in wrecking old plants and in handling and hoisting material, and on foundation work. When removing old and installing new cable on existing elevator installations, the Company may use two Helpers or Apprentices to one Mechanic.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Glazier Local 372

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN02-2024ib	Glazier	11/1/2024	11/1/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Glazier	$33.82		$6.20	$10.14	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$50.61	$67.52
Apprentice	BHR	Percent										
1st Year	$23.67	$70.00	$6.20	$2.84	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$33.16	$45.00
2nd Year	$25.37	$75.00	$6.20	$2.84	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$34.86	$47.54
3rd Year	$28.75	$85.00	$6.20	$6.55	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$41.95	$56.32
4th Year	$32.13	$95.00	$6.20	$6.55	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$45.33	$61.39

(*)Special Calculation Note :

No special calculations for this skilled craft wage rate are required at this time.

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Fayette*, Franklin, Hocking, Jackson, Knox, Licking, Madison, Marion, Morrow, Muskingum, Perry, Pickaway, Pike, Ross, Union, Vinton

Special Jurisdictional Note :

Fayette County - locations west of State Route 62 ONLY.

Details :

A premium of one dollar ($1.00) per hour above regular hourly rate of pay shall be paid for each hour worked by every employee from any mechanical lift or scaffold,either suspended or supported including the Hex type scaffolding.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Ironworker Local 172

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Ironworker	6/11/2025	6/11/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Ironworker	$40.87		$9.50	$9.50	$0.71	$0.00	$3.50	$0.00	$0.00	$0.00	$64.08	$84.52
Rigger Welder Reinforcing Sheeter Fence Erector Machinery Mover	$40.87		$9.50	$9.50	$0.71	$0.00	$3.50	$0.00	$0.00	$0.00	$64.08	$84.52
Apprentice	BHR	Percent										
1st Year 0-1500 Hours	$28.61	$70.00	$9.50	$9.50	$0.71	$0.00	$3.50	$0.00	$0.00	$0.00	$51.82	$66.12
2nd Year 1501-3000 Hours	$32.70	$80.00	$9.50	$9.50	$0.71	$0.00	$3.50	$0.00	$0.00	$0.00	$55.91	$72.25
3rd Year 3001-4500 Hours	$36.79	$90.02	$9.50	$9.50	$0.71	$0.00	$3.50	$0.00	$0.00	$0.00	$60.00	$78.40

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Champaign*, Clark*, Crawford*, Delaware, Fairfield, Fayette*, Franklin, Hardin*, Highland*, Hocking, Jackson*, Knox, Licking, Logan*, Madison*, Marion, Morrow, Perry, Pickaway, Pike, Ross, Union, Vinton, Wyandot*

Special Jurisdictional Note :

Champaign County Twps included: Wayne, Rush, Goshen. Clark County Twps included: Vienna, Catawba and portions of Harmony and Pleasant Crawford County Twps included: Bucyrus, Dallas, Jefferson, Jackson, Whetstone, Polk, Sandusky. Fayette County Twps included: Paint, Marion, Perry, Madison, Wayne, Union. Hardin County Twps included: McDonald, Taylorcreek, Hale, Dudley, Pleasant, Goshen, Blanchard, Lynn, Jackson, Buck, Cessna, Marion, Washington. Highland County Twps included: Madison. Jackson County Twps included: Liberty, Washington, Milton, Jackson, Coal, Wilkesville. Logan County Twps included: Monroe, Zane, Jefferson, Perry, Rush Creek, Bokes Creek. Madison County Twps included: Range, Paint, Fairfield, Sommerford, Jefferson, Pike, Canaan, Pleasant, Oak Run, Union, Deer Creek, Monroe, Darby. Pike County Twps included: Perry, Benton, Mifflin, Sunfish, Newton, Prebble, Pee Pee, Seal, Beaver, Jackson. Wyandot County Twps included: Jackson, Marseilles, Mifflin, Pitt, Antrim. Muskingum County includes:Jackson,Licking,Hope Well, Newton, Clay, Cass, Muskingum falls,Springfield,Madison,Washington,Wayne,Brush Creek.

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Ironworker Local 290

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Ironworker	6/11/2025	6/11/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Ironworker Structural	$37.39		$9.50	$9.50	$0.85	$0.00	$5.50	$0.00	$0.00	$0.00	$62.74	$81.44
Welder	$37.39		$9.50	$9.50	$0.85	$0.00	$5.50	$0.00	$0.00	$0.00	$62.74	$81.44
Fence Erector	$37.39		$9.50	$9.50	$0.85	$0.00	$5.50	$0.00	$0.00	$0.00	$62.74	$81.44
Reinforcing Rods	$37.39		$9.50	$9.50	$0.85	$0.00	$5.50	$0.00	$0.00	$0.00	$62.74	$81.44
Machinery Mover	$37.39		$9.50	$9.50	$0.85	$0.00	$5.50	$0.00	$0.00	$0.00	$62.74	$81.44
Sheeter	$37.39		$9.50	$9.50	$0.85	$0.00	$5.50	$0.00	$0.00	$0.00	$62.74	$81.44
Metal Building Erector	$37.39		$9.50	$9.50	$0.85	$0.00	$5.50	$0.00	$0.00	$0.00	$62.74	$81.44
Rigger & Erector	$37.39		$9.50	$9.50	$0.85	$0.00	$5.50	$0.00	$0.00	$0.00	$62.74	$81.44
Apprentice	BHR	Percent										
1st Year	$23.93	$64.00	$9.50	$9.50	$0.85	$0.00	$4.00	$0.00	$0.00	$0.00	$47.78	$59.74
2nd Year	$27.67	$74.00	$9.50	$9.50	$0.85	$0.00	$4.00	$0.00	$0.00	$0.00	$51.52	$65.35
3rd Year	$31.41	$84.00	$9.50	$9.50	$0.85	$0.00	$4.00	$0.00	$0.00	$0.00	$55.26	$70.96
4th Year	$35.15	$94.00	$9.50	$9.50	$0.85	$0.00	$4.00	$0.00	$0.00	$0.00	$59.00	$76.57

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Allen*, Auglaize, Butler*, Champaign*, Clark*, Clinton, Darke, Fayette*, Greene, Hardin*, Highland*, Logan*, Madison*, Mercer*, Miami, Montgomery, Preble, Shelby, Van Wert*, Warren*

Special Jurisdictional Note :

Allen County Twps included are: Auglaize, Perry, Shawnee, Amanda, Spencer, Marion, Sugar Creek, American, Bath, Jackson. Butler County Twps included are: Milford, Wayne, Madison, Lemon. Champaign County Twps included are: Union, Urbana, Jackson, Concord, Salem, Mad River, Johnson, Harrison, Adams. Clark County Twps included are: Bethel, German, Green, Mad River, Moorefield, Pike, Springfield and potions of Harmony, Madison, and Pleasant Fayette County Twps included are: Green, Jasper, Concord, Jefferson. Hardin County Twps included are: Round Head, Marion, Liberty. Highland County Twps included are: Fairfield, Penn, Union, Marshall, Liberty, Paint, Brush Creek. Logan County Twps included are: Richland, Stokes, Bloomfield, Washington, Harrison, McArthur, Lake, Liberty, Pleasant, Miami. Madison County Twps included are: Stokes. Mercer County Twps included are: Dublin, Washington, Jefferson, Recovery, Gibson, Union, Liberty, Butler, Granville, Center, Hopewell, Franklin, Marion. VanWert County Twps included are: Jennings. Warren County Twps included are: Franklin, Clear Creek, Turtle Creek, Wayne, Massie, Washington, Salem, Union.

Details :

Structural Iron Work but not limited to:field fabrication, all loading to and including the erecting,rigging,assembly,dismantling, placing, temporary and permanent securing by any means of all structural iron,steel,ornamental lead,bronze,brass,copper,aluminum,glass all ferrous and non ferrous metal and composite material, precast prestressed and post-stressed concrete structures. Bridges and bridge rails,bridge viaducts,bucks bulkheads,bumper and bumper post,canopies and unistrut canopies,corrugated ferrous and non ferrous sheets when attached to steel frames,columns,beams,bar-joists,trusses,grinders,roof decking,electrical supports,elevator cars,elevator fronts and enclosures,erection of steel towers,flag poles, gymnasium equipment,stadium and arena seating,jail cell work,jail cell beds,benches,bunks,chairs,tables,mirrors,jail cell access doors,rigging and installation of machinery and equipment(erecting,aligning,anchoring and dismantling, erection and dismantling of tower cranes,derrick monorail systems, Chicago booms,overhead cranes,gantries,material and personnel hoists,tanks,hoppers and conveyors. All pre-engineered metal buildings and their entirety including siding,roofing, gutters, downspouts and erection of all. Ornamental Iron Work but not limited to:all work in connection with field fabrication,handling including loading/off loading,sorting,cutting,fastening,anchoring,bending,hoisting,placing,burning,welding,and tying,dismantling of all materials used in miscellaneous iron or steel, for stairs,hand railings,rolling doors, rolling gates,rolling shutters,fence,windows,curtain wall,erection and welding of all metal, sash,architectural and ornamental treatments, but not necessarily limited to all sizes and types of ornamental,steel iron,lead,bronze,brass,copper,aluminum,all ferrous and non ferrous metals and composite materials . Fence Erector Iron Worker but not limited to: All work in connection with the field fabrication and erection of chain link fence,which includes but not limited to the loading and of the fence fabric and posts also the installation of the above. Reinforcing Iron Worker but not limited to: work in connection with field fabrication, handling, racking, sorting, cutting, bending, hoisting, placing, burning, welding and tying all materials used to reinforce concrete construction, except loading and unloading by hand. Re-aligning of the reinforced iron, wire mesh placing, bricking, pulling and similar reinforcing materials, placing steel dowels, as well as re-fasten. Reinforcing steel and wire mesh in roadways and sidewalks in connection with building construction. Also, erection and fabrication of pre-connection with building construction, also erection and fabrication of pre-stressed and precast joists, beams, columns, slabs; walls, roofs, tanks, manholes, trenches and covers. Handling of "J" or jack bars on slip forms. Metal decking similar to "corruform" when used for floor forms over metal or concrete supports either welded or clipped. Post tension, all loading and unloading, hoisting, placing and tying of all post tensioning cables. Placing and tying of all duct work in bonded post tension. All of the wrecking of cones, wedging of the tendons, stressing, cutting, repairing and grouting of bonded post tension.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Labor HevHwy 3

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN02-2025ib	Laborer	6/11/2025	6/11/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Laborer Group 1	$37.27		$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$53.37	$72.01
Group 2	$37.44		$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$53.54	$72.26
Group 3	$37.77		$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$53.87	$72.76
Group 4	$38.22		$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$54.32	$73.43
Watch Person	$32.00		$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$48.10	$64.10
Apprentice	BHR	Percent										
0-1000 hrs	$29.82	$80.00	$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$45.92	$60.82
1001-2000 hrs	$31.68	$85.00	$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$47.78	$63.62
2001-3000 hrs	$33.54	$90.00	$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$49.64	$66.41
3001-4000 hrs	$35.41	$95.00	$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$51.51	$69.21
More than 4000 hrs	$37.27	$100.00	$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$53.37	$72.01

(*)Special Calculation Note :

Watchmen have no Apprentices. Tunnel Laborer rate with air-pressurized add $1.00 to the above wage rate. Commercial Driver's License – Any Laborer required to utilize a valid Commercial Driver's License (CDL), are in compliance with necessary FMCSA regulations and approved by the Contractor to operate a Commercial Motor Vehicle (CMV), shall be paid one dollar ($1.00) per hour above the base rate for the entirety of their working shift.

Ratio :

1 Journeymen to 1 Apprentice 3 Journeymen to 1 Apprentice thereafter

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Darke, Defiance, Delaware, Fairfield, Fayette, Franklin, Fulton, Gallia, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Jackson, Jefferson, Knox, Lawrence, Licking, Logan, Madison, Marion, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Paulding, Perry, Pickaway, Pike, Preble, Putnam, Richland, Ross, Scioto, Seneca, Shelby, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne, Williams, Wyandot

Special Jurisdictional Note :

Hod Carriers and Common Laborers - Heavy, Highway, Sewer, Waterworks, Utility, Airport, Railroad, Industrial and Building Site, Sewer Plant, Waste Water Treatment Facilities Construction

Details :

Group 1 Laborer (Construction); Plant Laborer or Yardman, Right-of-way Laborer, Landscape Laborer, Highway Lighting Worker, Signalization Worker, (Swimming) Pool Construction Laborer, Utility Man, *Bridge Man, Handyman, Joint Setter, Flagperson, Carpenter Helper, Waterproofing Laborer, Slurry Seal, Seal Coating, Surface Treatment or Road Mix Laborer, Riprap Laborer & Grouter, Asphalt Laborer, Dump Man (batch trucks), Guardrail & Fence Installer, Mesh Handler & Placer, Concrete Curing Applicator, Scaffold Erector, Sign Installer, Hazardous Waste (level D), Diver Helper, Zone Person and Traffic Control. *Bridge Man will perfomr work as per the October 31, 1949, memorandum on concrete forms, byand between the United Brotherhood of Caprpenters and Joiners of Americ and the Laborers' International Union of North America, which states in; "the moving, cleaning, oiling and carrying to the next point of erection, and the stripping of forms which are not to be re-used, and forms on all flat arch work shall be done by memebers of the Laborers' International Union of North America." Group 2 Asphalt Raker, Screwman or Paver, Concrete Puddler, Kettle Man (pipeline), All Machine-Driven Tools (Gas, Electric, Air), Mason Tender, Brick Paver, Mortar Mixer, Skid Steer, Sheeting & Shoring Person, Surface Grinder Person, Screedperson, Water Blast, Hand Held Wand, Power Buggy or Power Wheelbarrow, Paint Striper, Plastic fusing Machine Operator, Rodding Machine Operator, Pug Mill Operator, Operator of All Vacuum Devices Wet or Dry, Handling of all Pumps 4 inches and under (gas, air or electric), Diver, Form Setter, Bottom Person, Welder Helper (pipeline), Concrete Saw Person, Cutting with Burning Torch, Pipe Layer, Hand Spiker (railroad), Underground Person (working in sewer and waterline, cleaning, repairing and reconditioning). Tunnel Laborer (without air),Caisson, Cofferdam (below 25 feet deep), Air Track and Wagon Drill, Sandblaster Nozzle Person, Hazardous Waste (level B), ***Lead Abatement, Hazardous Waste (level C) ***Includes the erecting of structures for the removal, including the encapsulation and containment of Lead abatement process. Group 3 Blast and Powder Person, Muckers will be defined as shovel men working directly with the miners, Wrencher (mechanical joints & utility pipeline), Yarner, Top Lander, Hazardous Waste (level A), Concrete Specialist, Curb Setter and Cutter, Grade Checker, Concrete Crew in Tunnels. Utility pipeline Tappers, Waterline, Caulker, Signal Person will receive the rate equal to the rate paid the Laborer classification for which the Laborer is signaling. Group 4 Miner,Welder, Gunite Nozzle Person A.) The Watchperson shall be responsible to patrol and maintain a safe traffic zone including but not limited to barrels, cones, signs, arrow boards, message boards etc. The responsibility of a watchperson is to see that the equipment, job and office trailer etc. are secure.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Labor Local 423

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Laborer	6/1/2025	6/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Laborer Group 1	$32.98		$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$47.53	$64.02
Group 2	$33.29		$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$47.84	$64.49
Group 3	$33.60		$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$48.15	$64.95
Group 4	$33.91		$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$48.46	$65.42
Apprentice	BHR	Percent										
0-1000 hrs	$23.09	$70.00	$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$37.64	$49.18
1001-2000 hrs	$26.38	$80.00	$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$40.93	$54.13
2001-3000 hrs	$29.68	$90.00	$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$44.23	$59.07
3001-4000 hrs	$31.33	$95.00	$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$45.88	$61.55
More than 4000 hrs	$32.98	$100.00	$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$47.53	$64.02

(*)Special Calculation Note :

Ratio :

1 Journeymen to 1 Apprentice 4 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Fairfield, Fayette, Franklin, Hocking, Licking, Madison, Pickaway, Union

Special Jurisdictional Note :

Details :

Group 1: General Laborers, Carpenter Tender, Cathodic Protection, Cleaning Debris, Cleaning of all Material, General Clean-up including Vacuum Cleaning, Scraping and Cleaning of Walls and Floors, Landscape, Installation and Removal of Fencing, Sod Layers, All Portable Heaters, Flagman, Loading and Unloading of all Trucks, Handling and conveying all Materials, Washing of all Windows, Conveyer Belt, All Water Pumps up to and including three (3) inch intake, Watchman, Water Boy and Tool Room Attendant. Group 1- Swimming Pools, Pool Decks, Surrounding Sidewalk and Parking Garages. Group 2: Skid Steer, Concrete Specialists, Brick Tender, Stone Mason Tender, Plaster Tender, Mortar Mixer and Operator, Cement Mason Tender, Construction Specialist, All Scaffold Builders (Swinging Scaffolds), Lagging, Bush Hammering,Jack Hammer Operator, Air or Electric Pneumatic Tool Operator, Power Driven Tools, Power Buggy Operators, Pouring and Placement of all concrete, Fork Lift Operators, Power Wheelbarrow Operators, Asphalt and Blacktop Rakers, Wrecker/Demolition, Sand Blasting and Chipping, Welders on Demolition, Grade Checkers, a person on a bucket pouring concrete, Gunite Nozzle man, Wagon and Churn Drill Operator, Concrete Saw Operator, Brush Feeders on pulverizers, Pipe Layers, Bottom Man, Laser Gun, Burners, Sand Blasting of concrete, Vibrator Man, Steward, Signal Man, Caisson, Caisson Bottom Man, Piledrivers, Asbestos and Lead Abatement Laborers. Hazardous Waste (Level B): Any work requiring the following protective equipment must be paid at Group 2 rate, A protective suit and an Air Purifying Respirator (APR) with the appropriate filter canisters. The ensemble is used when contaminants are reliably known not to be hazardous to the skin and not IDLH (Immediately Dangerous To Life or Health) and correct filter protection is available. This ensemble offers adequate protection for many jobs. Heat stress may be a problem due to inherent restrictions to breathing in an APR. Also, normal job related injury risk will be nearly as high as for Level C Equipment. Group 3 Hazardous (Level C:) Any work requiring the following protective equipment must be paid at Group 3 rate, A chemically resistant splash suit and a (SCBA) or Airline Respirator. This ensemble is required when the situation is very hazardous, such as oxygen deficient atmospheres, IDLH atmospheres, or confined space entries, but the risk of skin exposure is not as great as in Level D situations. Then Level C ensemble gives the second highest level of protection, but also puts physical stress on the worker; primarily heat stress, reduced vision,dexterity and mobility directly attributable to wearing of the protective equipment. Therefore, in addition to the hazardous material, the hazard of the normal job related injuries is greatly increased. Group 4 Hazardous Waste (Level D) requiring the following protective equipment must be paid at Group 4 rate, Protective equipment is required when the area has been known to contain extremely toxic contaminants or contaminants unknown but may be expected to be extremely toxic and /or Immediately Dangerous to Life and Health (IDLH). This ensemble includes fully encapsulated chemical suit (moon suit), Self Contained Breathing Apparatus (SCBA), or Airline Fed Respirator, and various types and numbers of boots and gloves, cool vests and voice activated radios are optional equipment sometimes worn. Level D ensembles provide the highest level of protection from contaminants but places the greatest physical and mental stress on the worker. The claustrophobic environment of the moon suit causes anxiety in most people, which greatly increases the already inherent heat stress problems. Also, this ensemble reduces vision, mobility, dexterity, and communication capacity, all of which increases the risk of normal job related injuries, ie., slips ,falls, caught between, etc . Hazardous Pay of $0.25 per hour shall be paid in addition to classifications shown above Swing Scaffolds (suspended by rope or pulley), and swing scaffolds for grain storage tank or grain elevators, when the work is performed at a height of fifty (50) feet or more above the foundations or grade level, whichever is higher. Caisson work and tunnel work (depth being 15 feet or deeper) Hazardous Waste Removal & Lead Abatement Workers: Exclusive or "Hot" area with toxic or hazardous materials, when one of the following personal protective equipment ensembles will be required for necessary protection against toxic contaminants. All of the ensembles increase the risks of certain types of worker-related injuries. When Laborers complement another craft receiving premium rate of pay Laborers will also receive premium pay for this "HOT" type of work.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Operating Engineers - Building Local 18 - Zone III

Type of Rate: Commercial

Change #: LCN01-2025ib

Craft: Operating Engineer

Effective Date: 5/1/2025

Effective Date: 5/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Operator Group A	$45.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$62.74	$85.66
Operator Group B	$45.72		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$62.62	$85.48
Operator Group C	$44.68		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$61.58	$83.92
Operator Group D	$43.50		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$60.40	$82.15
Operator Group E	$38.04		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$54.94	$73.96
Master Mechanic	$46.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.74	$87.16
Lift Director	$46.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.74	$87.16
Cranes & Mobile Concrete Pumps 150'-180'	$46.34		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.24	$86.41
Cranes & Mobile Concrete Pumps 180'-249'	$46.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.74	$87.16
Cranes & Mobile Concrete Pumps 249' and over	$47.09		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.99	$87.54
Apprentice	BHR	Percent										
1st Year	$22.92	$50.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$39.82	$51.28
2nd Year	$27.50	$60.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$44.40	$58.16
3rd Year	$32.09	$70.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$48.99	$65.03
4th Year	$36.67	$80.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$53.57	$71.91
Field Mechanic Trainee	$	$	$	$	$	$	$	$	$	$	$	$
1st Year	$27.50	$60.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$44.40	$58.16
2nd Year	$32.09	$70.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$48.99	$65.03
3rd Year	$36.67	$80.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$53.57	$71.91
4th Year	$41.26	$90.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$58.16	$78.78

(*)Special Calculation Note :

Other: Education & Safety Misc: National Training

Ratio :

For every (3) Operating Engineer Journeymen employed by the company there may be employed (1) Registered Apprentice or trainee Engineer through the referral when they are available. An apprenice, while employed as part of a crew per Article VIII, paragraph 77, will not be subject to the apprenticeship ratios in this collective bargaining agreement

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Coshocton, Crawford, Darke, Defiance, Delaware, Fairfield, Fayette, Franklin, Fulton, Gallia, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Jackson, Jefferson, Knox, Lawrence, Licking, Logan, Madison, Marion, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne, Williams, Wyandot

Special Jurisdictional Note :

Details :

Note: There will be a 10% increase for the apprentices on top of the percentages listed above provided they are operating mobile equipment. Group A- Barrier Moving Machines; Boiler Operators or Compressor Operators, when compressor or boiler is mounted on crane (Piggyback Operation); Boom Trucks (all types); Cableways Cherry Pickers; Combination - Concrete Mixers & Towers; All Concrete Pumps with Booms; Cranes (all types); Compact Cranes, track or rubber over 4,000 pounds capacity; Cranes self-erecting, stationary, track or truck (all configurations); Derricks (all types); Draglines; Dredges (dipper, clam or suction) 3-man crew; Elevating Graders or Euclid Loaders; Floating Equipment; Forklift (rough terrain with winch/hoist); Gradalls; Helicopter Operators, hoisting building materials; Helicopter Winch Operators, Hoisting building materials; Hoes (All types); Hoists (with two or more drums in use); Horizonal Directional Drill; Hydraulic Gantry (lift system); Laser Finishing Machines; Laser Screed and like equipment; Lift Slab or Panel Jack Operators; Locomotives (all types); Maintenance Operator/Technician(Mechanic Operator/Technician and/or Welder); Mixers, paving (multiple drum); Mobile Concrete Pumps, with booms; Panelboards, (all types on site); Pile Drivers; Power Shovels; Prentice Loader; Rail Tamper (with automatic lifting and aligning device); Rotary Drills (all), used on caissons for foundations and sub-structure; Side Booms; Slip Form Pavers; Straddle Carriers (Building Construction on site); Trench Machines (over 24” wide); Tug Boats. Group B - Articulating/end dumps (minus $4.00/hour from Group B rate); Asphalt Pavers; Bobcat-type and/or skid steer loader with hoe attachment greater than 7000 lbs.; Bulldozers; CMI type Equipment; Concrete Saw, Vermeer-type; Endloaders; Hydro Milling Machine; Kolman-type Loaders (Dirt Loading); Lead Greasemen; Mucking Machines; Pettibone-Rail Equipment; Power Graders; Power Scoops; Power Scrapers; Push Cats;, Rotomills (all), grinders and planers of all types. Group C - A-Frames; Air Compressors, Pressurizing Shafts or Tunnels; All Asphalt Rollers; Bobcat-type and/or Skid Steer Loader with or without attachments; Boilers (15 lbs. pressure and over); All Concrete Pumps (without booms with 5 inch system); Fork Lifts (except masonry); Highway Drills - all types (with integral power); Hoists (with one drum); House Elevators (except those automatic call button controlled), Buck Hoists, Transport Platforms, Construction Elevators; Hydro Vac/Excavator (when a second person is needed, the rate of pay will be “Class E”); Man Lifts; Material hoist/elevators; Mud Jacks; Pressure Grouting; Pump Operators (installing or operating Well Points or other types of Dewatering Systems); Pumps (4 inches and over discharge); Railroad Tie (Inserter/Remover); Rotovator (Lime-Soil Stabilizer); Submersible Pumps (4”and over discharge); Switch & Tie Tampers (without lifting and aligning device); Trench Machines (24” and under); Utility Operators. Group D - Backfillers and Tampers; Ballast Re-locator; Batch Plant Operators; Bar and Joint Installing Machines; Bull Floats; Burlap and Curing Machines; Clefplanes; Compressors, on building construction; Concrete Mixers, more than one bag capacity; Concrete Mixers, one bag capacity (side loaders); All Concrete Pumps (without boom with 4” or smaller system); Concrete Spreader; Conveyors, used for handling building materials; Crushers; Deckhands; Drum Fireman (in asphalt plants); Farm type tractors pulling attachments; Finishing Machines; Form Trenchers; Generators: Gunite Machines; Hydro-seeders; Pavement Breakers (hydraulic or cable); Post Drivers; Post Hole Diggers; Pressure Pumps (over 1/2”) discharge); Road Widening Trenchers; Rollers (except asphalt); Self-propelled sub-graders; Shotcrete Machines; Tire Repairmen; Tractors, pulling sheepsfoot post roller or grader; VAC/ALLS; Vibratory Compactors, with integral power; Welders. Group E – Allen Screed Paver (concrete); Boilers (less than 15 lbs. pressure); Cranes-Compact, track or rubber (under 4,000 pounds capacity); Directional Drill “Locator”; Fueling and greasing +$3.00; Inboard/outboard Motor Boat Launches; Light Plant Operators; Masonry Fork Lifts; Oilers/Helpers; Power Driven Heaters (oil fired); Power Scrubbers; Power Sweepers; Pumps (under 4 inch discharge); Signalperson, Submersible Pumps (under 4” discharge). Master Mechanics - Master Mechanic Cranes 150’ – 180’ - Boom & Jib 150 - 180 feet Cranes 180’ – 249’ - Boom & Jib 180 - 249 feet Cranes 250’ and over - Boom & Jib 250 feet or over

Prevailing Wage Rate
Skilled Crafts

Name of Union: Operating Engineers - HevHwy Zone II

Type of Rate: Commercial

Change #: LCN01-2025ib

Craft: Operating Engineer

Effective Date: 5/1/2025

Effective Date: 5/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Operator Class A	$45.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$62.74	$85.66
Operator Class B	$45.72		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$62.62	$85.48
Operator Class C	$44.68		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$61.58	$83.92
Operator Class D	$43.50		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$60.40	$82.15
Operator Class E	$38.04		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$54.94	$73.96
Master Mechanic	$46.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.74	$87.16
Lift Director	$46.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.74	$87.16
Crane and Mobile Concrete Pump 150' - 179'	$46.34		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.24	$86.41
Crane and Mobile Concrete Pump 180' - 249'	$46.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.74	$87.16
Crane and Mobile Concrete Pump 250' and Ove	$47.09		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.99	$87.54
Apprentice	BHR	Percent										
1st Year	$22.92	$50.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$39.82	$51.28
2nd Year	$27.50	$60.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$44.40	$58.16
3rd Year	$32.09	$70.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$48.99	$65.03
4th Year	$36.67	$80.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$53.57	$71.91
Field Mech Trainee	$	$	$	$	$	$	$	$	$	$	$	$
1st year	$27.50	$60.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$44.40	$58.16
2nd year	$32.09	$70.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$48.99	$65.03
3rd year	$36.67	$80.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$53.57	$71.91
4th year	$41.26	$90.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$58.16	$78.78

(*)Special Calculation Note :

Other: Education & Safety Fund Misc: National Training

Ratio :

For every (3) Operating Engineer Journeymen employed by the company, there may be employed (1) Registered Apprentice or Trainee Engineer through the referral when they are available. An Apprentice, while employed as part of a crew per Article VIII, paragraph 68 will not be subject to the apprenticeship ratios in this collective bargaining agreement

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Coshocton, Crawford, Darke, Defiance, Delaware, Fairfield, Fayette, Franklin, Fulton, Gallia, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lawrence, Licking, Logan, Lucas, Madison, Marion, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne, Williams, Wood, Wyandot

Special Jurisdictional Note :

Details :

**Apprentices wilt receive a 10% increase on top of the percentages listed above provided they are operating mobile equipment. Class A - Air Compressors on Steel Erection; Asphalt Plant Engineers (Cleveland District Only); Barrier Moving Machine; Boiler Operators, Compressor Operators, or Generators, when mounted on a rig; Boom Trucks (all types); Cableways; Cherry Pickers; Combination- Concrete Mixers & Towers; Concrete Plants (over 4 yd capacity); Concrete Pumps; Cranes (all types); Compact Cranes track or rubber over 4,000 pounds capacity; Cranes self-erecting stationary, track or truck; Derricks (all types); Draglines; Dredges dipper, clam or suction; Elevating Graders or Euclid Loaders; Floating Equipment (all types); Gradalls; Helicopter Crew (Operator- hoist or winch); Hoes (all types); Hoisting Engines; Hoisting Engines, on shaft or tunnel work; Hydraulic Gantry (lifting system); Industrial-type Tractors; Jet Engine Dryer (D8 or D9) diesel Tractors; Locomotives (standard gauge); Maintenance Operators/Technicians (class A); Mixers, paving (single or double drum); Mucking Machines; Multiple Scrapers; Piledriving Machines (all types); Power Shovels, Prentice Loader; Quad 9 (double pusher); Rail Tamper (with automatic lifting and aligning device); Refrigerating Machines (freezer operation); Rotary Drills, on caisson work; Rough Terrain Fork Lift with winch/hoist; Side Booms; Slip Form Pavers; Survey Crew Party Chiefs; Tower Derricks; Tree Shredders; Trench Machines (over 24" wide); Truck Mounted Concrete Pumps; Tug Boats; Tunnel Machines and /or Mining Machines; Wheel Excavators. Class B - Asphalt Pavers; Automatic Subgrade Machines, self-propelled (CMI-type); Bobcat-type and /or Skid Steer Loader with hoe attachment greater than 7000 lbs.; Boring Machine Operators (more than 48 inches); Bulldozers; Concrete Saws, Vermeer type; Endloaders; Horizontal Directional Drill (50,000 ft. lbs. thrust and over); Hydro Milling Machine; Kolman-type Loaders (production type-dirt); Lead Greasemen; Lighting and Traffic Signal Installation Equipment includes all groups or classifications; Maintenance Operators/Technicians, Class B; Material Transfer Equipment (shuttle buggy) Asphalt; Pettibone-Rail Equipment; Power Graders; Power Scrapers; Push Cats; Rotomills (all), Grinders and Planners of all types, Groovers (excluding walk-behinds); Trench Machines (24 inch wide and under). Class C - A-Frames; Air Compressors, on tunnel work (low Pressure); Articulating/straight bed end dumps if assigned (minus $4.00 per hour); Asphalt Plant Engineers (Portage and Summit Counties only); Bobcat-type and/or skid steer loader with or without attachments; Drones; Highway Drills (all types); HydroVac/Excavator (when a second person is needed, the rate of pay will be "Class E"); Locomotives (narrow gauge); Material Hoist/Elevators; Mixers, concrete (more than one bag capacity); Mixers, one bag capacity (side loader); Power Boilers (over 15 lbs. pressure); Pump Operators (installing or operating well Points); Pumps (4 inch and over discharge); Railroad Tie Inserter/Remover; Rollers, Asphalt; Rotovator (lime-soil Stabilizer); Switch & Tie Tampers (without lifting and aligning device); Utilities Operators, (small equipment); Welding Machines and Generators. Class D – Backfillers and Tampers; Ballast Re-locator; Bar and Joint Installing Machines; Batch Plant Operators; Boring Machine Operators (48 inch or less); Bull Floats; Burlap and Curing Machines; Concrete Plants (capacity 4 yds. and under); Concrete Saws (multiple); Conveyors (highway); Crushers; Deckhands; Farm type tractors, with attachments (highway); Finishing Machines; Firemen, Floating Equipment (all types); Fork Lifts (highway), except masonry; Form Trenchers; Hydro Hammers; Hydro Seeders; Pavement Breakers (hydraulic or cable); Plant Mixers; Post Drivers; Post Hole Diggers; Power Brush Burners; Power Form Handling Equipment; Road Widening Trenchers; Rollers (brick, grade, macadam); Self-Propelled Power Spreaders; Self-Propelled Sub-Graders; Steam Firemen; Survey Instrument men; Tractors, pulling sheepsfoot rollers or graders; Vibratory Compactors, with integral power. Class E - Compressors (portable, Sewer, Heavy and Highway); Cranes-Compact, track or rubber under 4,000 pound capacity; Drum Firemen (asphalt plant); Fueling and greasing (Primary Operator with Specialized CDL Endorsement Add $3.00/hr); Generators; Inboard-Outboard Motor Boat Launches; Masonry Fork Lifts; Oil Heaters (asphalt plant); Oilers/Helpers; Power Driven Heaters (oil fired); Power Scrubbers; Power Sweepers; Pumps (under 4 inch discharge); Signalperson; Survey Rodmen or Chairmen; Tire Repairmen; VAC/ALLS. Master Mechanic - Master Mechanic Cranes and Mobile Concrete Pumps 150' -179' - Boom & Jib 150 - 179 feet Cranes and Mobile Concrete Pumps 180' - 249' - Boom & Jib 180 - 249 feet Cranes and Mobile Concrete Pumps 250' and over - Boom & Jib 250 feet or over

Prevailing Wage Rate
Skilled Crafts

Name of Union: Painter Local 1275

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2024ib	Painter	5/8/2024	5/8/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Painter Brush Roll	$29.20		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$44.46	$59.06
Wall Washer	$29.20		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$44.46	$59.06
Spray	$29.70		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$44.96	$59.81
Structural Steel Swing Stage	$29.50		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$44.76	$59.51
Sandblast, Steam Clean, Water Blasting (3500 PSI and Over) and Hazardous	$29.90		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$45.16	$60.11
Vinyl Hanging	$29.70		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$44.96	$59.81
Apprentice	BHR	Percent										
0-1500 hrs	$23.36	$80.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$31.08	$42.76
1501-3000 hrs	$24.82	$85.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$32.54	$44.95
3001-4500 hrs	$26.28	$90.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$34.00	$47.14
4501-6000 hrs	$27.74	$95.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$35.46	$49.33

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Fayette, Franklin, Knox, Licking, Madison, Muskingum, Perry, Pickaway, Ross, Union

Special Jurisdictional Note :

Details :

Heavy Highway Class 1 are qualified painters,blasters,riggers. Class 2 Equipment Tenders /or containment Builders are hired to tend employers equipment also engage in the building & moving of containment systems. Class 3 support personnel will perform Quality control duties,clean abrasive blast materials, load and unload trucks, handle all materials, man safety boats, & handle traffic control. All Tanks 50,000 gallon capacity or more will be at the tank stated rate.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Painter Local 1275 Drywall

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2024ib	Painter	5/8/2024	5/8/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Painter Drywall Finisher	$30.85		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$46.11	$61.54
Drywall Taper	$30.85		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$46.11	$61.54
Drywall Sanders	$30.20		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$45.46	$60.56
Drywall, Use of Mechanical or Pneumatic Tools	$31.60		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$46.86	$62.66
Apprentice	BHR	Percent										
1st 0-1500 hrs	$24.68	$80.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$32.40	$44.74
2nd 1501-3000 hrs	$26.22	$85.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$33.94	$47.05
3rd 3001-4500 hrs	$27.77	$90.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$35.49	$49.37
4th 4501-6000 hrs	$29.31	$95.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$37.03	$51.68

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Fayette, Franklin, Knox, Licking, Madison, Muskingum, Perry, Pickaway, Ross, Union

Special Jurisdictional Note :

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Painter Local 1275 HevHwy

Type of Rate: Commercial

Change #: LCN01-2024ib

Craft: Painter

Effective Date: 5/8/2024

Effective Date: 5/8/2024

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Painter Bridge Class 1	$39.26	$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$54.52	$74.15
Painter Bridges Class 2 Rigger, Containment Builder, Spot Blaster	$36.26	$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$51.52	$69.65
Painter Bridges Class 3 Equipment Operator/ Field Mechanic, Grit Reclamation, Paint Mix, Traffic Control, Boat Person, Driver (0-5 Years Exp.)	$29.26	$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$44.52	$59.15
Painter Bridges Class 3 Equipment Operator/ Field Mechanic, Grit Reclamation, Paint Mix, Trafiic Control, Boat Person, Driver (plus 5 Years Exp.)	$32.26	$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$47.52	$63.65
Painter Bridges Class 4 Concrete Sealing, Concrete Blasting Power Washing	$28.26	$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$43.52	$57.65

Painter Bridges Class 5 Quality Control, Quality Assurance, Traffic Safety Competent Person	$32.26		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$47.52	$63.65
Apprentice	BHR	Percent										
1st 0-1500 hrs	$31.41	$80.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$39.13	$54.83
2nd 1501-3000 hrs	$33.37	$85.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$41.09	$57.78
3rd 3001-4500 hrs	$35.33	$90.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$43.05	$60.72
4th 4501-6000 hrs	$37.30	$95.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$45.02	$63.67

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Fayette, Franklin, Knox, Licking, Madison, Muskingum, Perry, Pickaway, Ross, Union

Special Jurisdictional Note :

Details :

Heavy Highway Class 1 are qualified painters,blasters,riggers. Class 2 Equipment Tenders /or containment Builders are hired to tend employers equipment also engage in the building & moving of containment systems. Class 3 support personnel will perform Quality control duties,clean abrasive blast materials, load and unload trucks, handle all materials, man safety boats, & handle traffic control.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Painter Local 1275 Industrial

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2023ib	Painter	5/8/2024	5/8/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Painter Brush Roll	$30.65		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$45.91	$61.24
Power Tool Cleaningr	$30.65		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$45.91	$61.24
Spray Painting	$31.15		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$46.41	$61.99
Sand Blast, Steam Clean & Pressure Washing Above 3500 PSI	$31.35		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$46.61	$62.29
Stacks and towers	$33.46		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$48.72	$65.45
Tanks - All Tanks 50,000 gallon capacity or more	$33.46		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$48.72	$65.45
Apprentice	BHR	Percent										
0-1500 hrs	$24.52	$80.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$32.24	$44.50
1501-3000 hrs	$26.05	$85.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$33.77	$46.80
3001-4500 hrs	$27.59	$90.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$35.31	$49.10
4501-6000 hrs	$29.12	$95.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$36.84	$51.40

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Fayette, Franklin, Knox, Licking, Madison, Muskingum, Perry, Pickaway, Ross, Union

Special Jurisdictional Note :

Details :

Definition of Industrial Classification: Industrial Facilities to be included in the Industrial Classification shall include; Water Treatment, Waste Water Treatment, Natural Gas and related facilities, refineries, transmission pipe lines, electrical transmission towers and or switching /sub stations and Power Plants. Exclusions from the industrial classification are Power Plants that generate power to a single customer; such as an emergency power supplier or a Hospital, Information Technology Facility, Sporting/Event or Arena/Stadium type facility. This exclusion would also be given to any commercial office space located within the facilities property. The excluded spaces shall be done under the Commercial Wage rates.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Painter Local 639 Sign and Display

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Painter	6/18/2025	6/18/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Top Mechanic Class A	$27.53		$4.50	$0.00	$0.00	$0.00	$0.00	$1.45	$0.00	$0.00	$33.48	$47.25
Top Mechanic Class B	$27.53		$4.50	$0.75	$0.00	$0.53	$0.00	$1.45	$0.00	$0.00	$34.76	$48.53
Top Helper Class A	$22.33		$4.50	$0.00	$0.00	$0.00	$0.00	$1.20	$0.00	$0.00	$28.03	$39.20
Top Helper Class B	$22.33		$4.50	$0.75	$0.00	$0.43	$0.00	$1.20	$0.00	$0.00	$29.21	$40.38
Helper Class A	$17.19		$4.50	$0.00	$0.00	$0.00	$0.00	$0.90	$0.00	$0.00	$22.59	$31.19
Helper Class B	$17.19		$4.50	$0.75	$0.00	$0.30	$0.00	$0.90	$0.00	$0.00	$23.64	$32.24
New Hire (90 Days)	$15.75		$4.50	$0.00	$0.00	$0.00	$0.00	$0.55	$0.00	$0.00	$20.80	$28.68
Apprentice	BHR	Percent										

(*)Special Calculation Note :

Other: Sick, Personal & Holiday Pay Swing Stage Rate: Employees shall receive a differential of $1.50 per hour for all hours worked on scaffolds four sections or higher, including any boom lifts and swing stage scaffolds. In addition, the rigging and derigging of hanging/suspended swing stage systems and rappelling/bolson chair work of a single employee will qualify for $1.50 differential, will be paid to a single lead Top Mechanic or single lead Top Helper on any given swing stage job, even when it includes multiple running rigs on a single jobsite.

Ratio :

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Gallia, Geauga, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Lucas, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Portage, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne, Williams, Wood, Wyandot

Special Jurisdictional Note :

Details :

The work performed by employees covered by this rate shall include cleaning and refinishing of architectural metals using chemicals, solvents, coatings and hand-applied lacquer thinner, removing scratches from mirror finished metals, burnishing of bronze, statuary finishes on exterior and interior surfaces during the course of the restoration and maintenance of architectural metals, and other specialty metal finishing work, and the use of all tools required to perform such work, including but not limited to polishes, spray equipment and scaffolding. Class A: Less Than 1 Year of Service Class B: More Than 1 Year of Service Top Mechanic: Top Mechanic shall be responsible for ensuring the highest quality of workmanship by Helpers, and be highly competent and knowledgeable in the following areas: coatings, both solvent and waterborne, spraying ability, stainless steel, aluminum and bronze finishing, scaffolding and swing stage work. The Top Mechanic shall also be responsible for providing necessary training of employees in lower classifications and for directing all employees in his/her crew to perform their responsibilities in a productive and efficient manner. Top Helper: For existing Top Helpers at the time of this Agreement shall, in addition to performing the responsibilities of a Helper, be responsible and accountable for the setup, breakdown, safety and quality of the Company's product. Helper: A Helper shall be responsible for performing tasks in refinishing, compliance with safety procedures, setting up and breaking down job sites, setting up and breaking down scaffolding and swing stages, preparing surfaces for refinishing, including but not limited to masking and stripping, cleaning, oxidizing, polishing and scratch removal on various finishes.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Painter Local 639 Zone 2 Sign

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Painter	5/28/2025	5/28/2025

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Painter Sign Journeyman Tech/Team Leader Class A	$26.56	$3.36	$0.21	$0.00	$0.00	$0.00	$0.72	$0.00	$0.00	$30.85	$44.13
Painter Sign Journeyman Tech/Team Leader Class B	$26.56	$3.36	$0.21	$0.00	$0.51	$0.00	$0.72	$0.00	$0.00	$31.36	$44.64
Painter Sign Journeyman Tech/Team Leader Class C	$26.56	$3.36	$0.21	$0.00	$1.02	$0.00	$0.72	$0.00	$0.00	$31.87	$45.15
Painter Sign Journeyman Tech/Team Leader Class D	$26.56	$3.36	$0.21	$0.00	$1.53	$0.00	$0.72	$0.00	$0.00	$32.38	$45.66
Sign Journeyman Class A	$26.27	$3.36	$0.21	$0.00	$0.00	$0.00	$0.71	$0.00	$0.00	$30.55	$43.69
Sign Journeyman Class B	$26.27	$3.36	$0.21	$0.00	$0.51	$0.00	$0.71	$0.00	$0.00	$31.06	$44.20
Sign Journeyman Class C	$26.27	$3.36	$0.21	$0.00	$1.01	$0.00	$0.71	$0.00	$0.00	$31.56	$44.70
Sign Journeyman Class D	$26.27	$3.36	$0.21	$0.00	$1.52	$0.00	$0.71	$0.00	$0.00	$32.07	$45.21
Tech Sign Fabrication/ Erector Class A	$20.67	$3.36	$0.21	$0.00	$0.00	$0.00	$0.56	$0.00	$0.00	$24.80	$35.14
Tech Sign Fabrication/ Erector Class B	$20.67	$3.36	$0.21	$0.00	$0.40	$0.00	$0.56	$0.00	$0.00	$25.20	$35.54

Tech Sign Fabrication/ Erector Class C	$20.67		$3.36	$0.21	$0.00	$0.80	$0.00	$0.56	$0.00	$0.00	$25.60	$35.94
Tech Sign Fabrication/ Erector Class D	$20.67		$3.36	$0.21	$0.00	$1.19	$0.00	$0.56	$0.00	$0.00	$25.99	$36.33
Apprentice	BHR	Percent										

(*)Special Calculation Note :

Other is for paid holidays.

Ratio :

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Auglaize, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Greene, Hamilton, Hancock, Hardin, Henry, Highland, Holmes, Huron, Jackson, Knox, Licking, Logan, Lorain, Lucas, Madison, Mahoning, Marion, Mercer, Miami, Montgomery, Morrow, Muskingum, Ottawa, Paulding, Perry, Pickaway, Pike, Preble, Putnam, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Trumbull, Tuscarawas, Union, Van Wert, Warren, Wayne, Williams, Wood, Wyandot

Special Jurisdictional Note :

Details :

Class A: less that 1 year. Class B: 1-3 years. Class C; 3-10 years. Class D: More than 10 years.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Plasterer Local 132 (Columbus)

Type of Rate: Commercial

Change #: LCN01-2025ib

Craft: Plasterer

Effective Date: 6/1/2025

Effective Date: 6/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Plasterer	$31.68		$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$47.14	$62.98
Fireproofing Gunner	$32.68		$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$48.14	$64.48
Apprentice	BHR	Percent										
1st 800 hrs	$22.18	$70.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$37.64	$48.72
2nd 800 hrs	$23.44	$74.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$38.90	$50.62
3rd 800 hrs	$24.71	$78.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$40.17	$52.53
4th 800 hrs	$25.98	$82.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$41.44	$54.43
5th 800 hrs	$27.24	$86.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$42.70	$56.33
6th 800 hrs	$28.51	$90.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$43.97	$58.23
7th 800 hrs	$29.78	$94.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$45.24	$60.13
8th 800 hrs	$31.05	$98.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$46.51	$62.03

(*)Special Calculation Note :

*Other is International Training Fund

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Ashland, Coshocton, Crawford, Delaware, Fairfield, Fayette, Franklin, Guernsey, Hocking, Knox, Licking, Madison, Marion, Morrow, Muskingum, Perry, Pickaway, Richland, Ross, Union, Vinton, Wyandot

Special Jurisdictional Note :

Details :

Fireproofing Gunner: If any mechanical means is used in the gauging of lime for any finish coat, the mixing shall be gauged by a member of the crew who is to apply the respective gauging. This clause applies on jobs where cementitious and fibrous type fireproofing is the material being applied. There shall be an equal number of plasterers to nozzles used. Working on swing stage, slip scaffold or window jack scaffold shall receive the following rates: $0 above the regular rate for heights up to forty-nine (49) feet above grade level $0.75 above the regular rate for heights over fifty (50) feet above grade level

Prevailing Wage Rate
Skilled Crafts

Name of Union: Plumber Pipefitter Local 189

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2024ib	Plumber Pipefitter	8/21/2024	8/21/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Plumber Pipefitter	$49.00		$10.39	$7.49	$1.45	$0.00	$8.26	$0.00	$0.00	$0.00	$76.59	$101.0
Heating Piping Refrigeration, Temperature Control, Air Conditioning Welder	$49.00		$10.39	$7.49	$1.45	$0.00	$8.26	$0.00	$0.00	$0.00	$76.59	$101.09
Apprentice	BHR	Percent										
1st Year	$22.05	$45.00	$5.00	$0.00	$1.45	$0.00	$0.00	$0.10	$0.00	$0.00	$28.60	$39.63
2nd Year	$24.50	$50.00	$10.39	$5.60	$1.45	$0.00	$0.00	$0.10	$0.00	$0.00	$42.04	$54.29
3rd Year	$26.95	$55.00	$10.39	$5.60	$1.45	$0.00	$0.00	$0.10	$0.00	$0.00	$44.49	$57.97
4th Year	$31.85	$65.00	$10.39	$5.60	$1.45	$0.00	$6.26	$0.10	$0.00	$0.00	$55.65	$71.58
5th Year	$39.20	$80.00	$10.39	$5.60	$1.45	$0.00	$8.26	$0.10	$0.00	$0.00	$65.00	$84.60

(*)Special Calculation Note :

*Other is International Training

Ratio :

Employees-------Journeyman to Apprentice per Job 1) 1-0 2) 1-1 3) 2-1 4) 2-2 5) 3-2 6) 4-2 7) 4-3 8) 5-3 9) 6-3 10) 6-4 11) 7-4 12) 8-4 13) 8-5 14) 9-5 15) 10-5 16) 10-6 17) 11-6 18) 12-6 19) 12-7 20) 13-7 21) 14-7 22) 14-8 23) 15-8 24) 16-8 25) 16-9 Heating Piping refrigeration,Temperature Control,Air Conditioning Ratio (1) Additional Apprentice to (3) Journeymen thereafter Employees Journeyman to Apprentice per Job 1) Employee 1-0 2) Employees 1-1 3) Employees 2-1 4) Employees 2-2 5)Employees 3-2 6) Employees 4-2 7) Employees 5-2 8) Employees 5-3 9) Employees 6-3 10)Employees 7-3 11)Employees 8-3 12)Employees 8-4 13)Employees 9-4 14)Employees 10-4 15)Employees 11-4 16) Employees 11-5 17) Employees 12-5 18) Employees 13-5 19) Employees 14-5 20)Employees 14-6 21)Employees 15-6 22)Employees 17-5 23)Employees 18-5 24)Employees 18-6 25)Employees 19-6 26)Employees 20-6 28)Employees 22-6 29)Employees 22-7 30) Employees 23-7 31)Employees 23-7 32) Employees 25-7 33)Employees 26-7 34)Employees 26-8

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Franklin, Hocking, Licking, Madison, Marion, Perry, Pickaway, Ross, Union

Special Jurisdictional Note :

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Roofer Local 86

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Roofer	9/3/2025	9/3/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Roofer	$38.33		$8.20	$7.40	$0.88	$0.00	$0.30	$0.09	$0.00	$0.00	$55.20	$74.36
Apprentice	BHR	Percent										
1st Year	$24.91	$65.00	$0.00	$0.00	$0.88	$0.00	$0.25	$0.09	$0.00	$0.00	$26.13	$38.59
2nd Year	$27.60	$72.00	$8.20	$1.85	$0.88	$0.00	$0.25	$0.09	$0.00	$0.00	$38.87	$52.67
3rd Year	$30.66	$80.00	$8.20	$3.33	$0.88	$0.00	$0.25	$0.09	$0.00	$0.00	$43.41	$58.74
4th Year	$33.73	$88.00	$8.20	$4.81	$0.88	$0.00	$0.25	$0.09	$0.00	$0.00	$47.96	$64.83

(*)Special Calculation Note :

Other: Education & Research Fund

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Champaign, Delaware, Fairfield, Fayette, Franklin, Hardin, Hocking, Knox, Licking, Logan, Madison, Marion, Morrow, Perry, Pickaway, Pike, Ross, Union, Wyandot

Special Jurisdictional Note :

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Sheet Metal Local 24 (Columbus)

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Sheet Metal Worker	6/11/2025	6/11/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Sheet Metal Worker	$41.10		$10.23	$12.56	$1.26	$0.00	$4.12	$0.00	$0.00	$0.00	$69.27	$89.82
Apprentice	BHR	Percent										
1st Year	$23.43	$57.00	$8.42	$2.19	$1.05	$0.00	$0.00	$0.00	$0.00	$0.00	$35.09	$46.80
2nd Year	$26.72	$65.00	$9.61	$8.17	$1.05	$0.00	$0.00	$0.00	$0.00	$0.00	$45.55	$58.90
3rd Year	$30.83	$75.00	$9.84	$9.42	$1.26	$0.00	$3.09	$0.00	$0.00	$0.00	$54.44	$69.85
4th Year	$34.94	$85.00	$9.99	$10.67	$1.26	$0.00	$3.50	$0.00	$0.00	$0.00	$60.36	$77.82

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice 2 Journeymen to 2 Apprentices 3 Journeymen to 3 Apprentices 4 Journeymen to 4 Apprentices 5-7 Journeymen to 5 Apprentices 8-10 Journeymen to 6 Apprentices 11-13 Journeyman to 7 Apprentices 14-16 Journeyman to 8 Apprentices 17-19 Journeymen to 9 Apprentices 20-22 Journeymen to 10 Apprentices 23-25 Journeymen to 11 Apprentices 26-28 Journeymen to 12 Apprentices 29-31 Journeymen to 13 Apprentices 32-34 Journeymen to 14 Apprentices 35-37 Journeymen to 15 Apprentices 38-40 Journeymen to 16 Apprentices and so on

Jurisdiction (* denotes special jurisdictional note) :

Adams, Athens, Delaware, Fairfield, Fayette, Franklin, Gallia, Guernsey, Hocking, Jackson, Knox, Lawrence, Licking, Madison, Marion, Meigs, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Pike, Ross, Scioto, Union, Vinton

Special Jurisdictional Note :

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Sprinkler Fitter Local 669

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCR01-2025ib	Sprinkler Fitter	8/6/2025	8/6/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Sprinkler Fitter	$48.28		$12.40	$7.40	$0.54	$0.00	$7.74	$0.00	$0.00	$0.00	$76.36	$100.5
Apprentice	BHR	Percent										
CLASS 1	$24.14	$50.00	$9.03	$0.00	$0.54	$0.00	$0.00	$0.00	$0.00	$0.00	$33.71	$45.78
CLASS 2	$27.04	$56.00	$9.03	$0.00	$0.54	$0.00	$0.00	$0.00	$0.00	$0.00	$36.61	$50.13
CLASS 3	$29.45	$61.00	$12.40	$7.40	$0.54	$0.00	$1.15	$0.00	$0.00	$0.00	$50.94	$65.66
CLASS 4	$31.38	$65.00	$12.40	$7.40	$0.54	$0.00	$1.15	$0.00	$0.00	$0.00	$52.87	$68.56
CLASS 5	$33.31	$69.00	$12.40	$7.40	$0.54	$0.00	$1.40	$0.00	$0.00	$0.00	$55.05	$71.70
CLASS 6	$36.21	$75.00	$12.40	$7.40	$0.54	$0.00	$1.40	$0.00	$0.00	$0.00	$57.95	$76.05
CLASS 7	$38.14	$79.00	$12.40	$7.40	$0.54	$0.00	$1.40	$0.00	$0.00	$0.00	$59.88	$78.95
CLASS 8	$40.56	$84.00	$12.40	$7.40	$0.54	$0.00	$1.40	$0.00	$0.00	$0.00	$62.30	$82.58
CLASS 9	$42.97	$89.00	$12.40	$7.40	$0.54	$0.00	$1.40	$0.00	$0.00	$0.00	$64.71	$86.19
CLASS 10	$44.90	$93.00	$12.40	$7.40	$0.54	$0.00	$1.40	$0.00	$0.00	$0.00	$66.64	$89.09

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Gallia, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lawrence, Licking, Logan, Lucas, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Portage, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne, Williams, Wood, Wyandot

Special Jurisdictional Note :

Details :

Sprinkler Fitter work shall consist of the installation, dismantling, maintenance, repairs, adjustments, and corrections of all fire protection and fire control systems including the unloading, handling by hand, power equipment and installation of all piping or tubing, appurtenances and equipment pertaining thereto, including both overhead and underground water mains, fire hydrants and hydrant mains, standpipes and hose connections to sprinkler systems used in connection with sprinkler and alarm systems. Also all tanks and pumps connected thereto, also included shall be CO-2 and Cardox Systems, Dry Chemical Systems, Foam Systems and all other fire protection systems.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Truck Driver Locals 20,40,92,100,175,284,348,377,637,697,908,957 - Bldg & HevHwy Class 1

Type of Rate: Commercial

Change #:
LCN01-2025ib

Craft:
Truck Driver

Effective Date:
5/28/2025

Effective Date:
5/28/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Truck Driver CLASS 1	$34.26		$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$53.51	$70.64
Apprentice	BHR	Percent										
First 6 months	$27.41	$80.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$46.66	$60.36
7-12 months	$29.12	$85.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$48.37	$62.93
13-18 months	$30.83	$90.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$50.08	$65.50
19-24 months	$32.55	$95.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$51.80	$68.07
25-30 months	$34.26	$100.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$53.51	$70.64

(*)Special Calculation Note :

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Gallia, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lawrence, Licking, Logan, Lorain, Lucas, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Portage, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne, Williams, Wood, Wyandot

Special Jurisdictional Note :

Details :

CLASS 1: Drivers on trucks, including but not limited to: 4-wheel service trucks; 4-wheel dump trucks; batch trucks; drivers on tandems; truck sweepers (not to include power sweepers and scrubbers) Drivers on tractor – trailer combinations including but not limited to the following: Semi-tractor trucks; pole trailers; ready-mix trucks; fuel trucks; all trucks five (5) axle and over; drivers on belly dumps; truck mechanics (when needed).

Prevailing Wage Rate
Skilled Crafts

Name of Union: Truck Driver Locals 20,40,92,100,175,284,348,377,637,697,908,957 - Bldg & HevHwy Class 2

Type of Rate: Commercial

Change #:
LCN01-2025ib

Craft:
Truck Driver

Effective Date:
5/28/2025

Effective Date:
5/28/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Truck Driver CLASS 2	$35.26		$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$54.51	$72.14
Apprentice	BHR	Percent										
First 6 months	$28.21	$80.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$47.46	$61.56
7-12 months	$29.97	$85.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$49.22	$64.21
13-18 months	$31.73	$90.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$50.98	$66.85
19-24 months	$33.50	$95.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$52.75	$69.50
25-30 months	$35.26	$100.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$54.51	$72.14

(*)Special Calculation Note :

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Gallia, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lawrence, Licking, Logan, Lorain, Lucas, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Portage, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne, Williams, Wood, Wyandot

Special Jurisdictional Note :

Details :

CLASS 2: Drivers on articulated dump trucks; rigid-frame rock trucks; distributor trucks; low boys/drag driver on the construction site only and heavy duty equipment (irrespective of load carried) when used exclusively for transportation on the construction site only.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Asbestos Local 207

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Asbestos Worker	8/6/2025	8/6/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Asbestos Abatement	$32.50		$10.95	$7.25	$0.75	$3.75	$0.00	$0.05	$0.00	$0.00	$55.25	$71.50
Apprentice	BHR	Percent										
Trainee	$22.00	$67.69	$10.95	$1.90	$0.75	$1.00	$0.00	$0.05	$0.00	$0.00	$36.65	$47.65

(*)Special Calculation Note :

Other: Drug Testing

Ratio :

3 Journeymen to 1 Trainee

Jurisdiction (* denotes special jurisdictional note) :

Adams, Ashland, Ashtabula*, Athens, Auglaize, Brown, Butler*, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Delaware, Erie*, Fairfield, Fayette, Franklin, Geauga, Greene, Guernsey, Hamilton, Hardin, Harrison, Highland, Hocking, Holmes, Huron, Knox, Lake, Licking, Logan, Lorain, Madison, Mahoning, Marion, Medina, Miami, Montgomery, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Portage, Preble, Richland, Ross, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Vinton, Warren*, Wayne

Special Jurisdictional Note :

Ashtabula County: (post offices & townships of Ashtabula, Austinburg, Geneva, Harperfield, Jefferson, Plymouth & Saybrook) (townships of Andover, Cherry Valley, Colbrook, Canneaut, Denmark, Dorset, East Orwell, Hartsgrove, Kingville, Lenox, Monroe,Morgan,New Lyme,North Kingsville, Orwell, Pierpoint, Richmond Rock Creek, Rome, Shefield, Trumbull, Wayne, Williamsfield & Windsor)

Butler County: (townships of Fairfield, Hanover, Liberty, Milford, Morgan, Oxford, Ripley, Ross, St. Clair, Union & Wayne) (Lemon & Madison)

Erie County: (post offices & townships of Berlin, Berlin Heights,Birmingham,Florence, Huron, Milan, Shinrock & Vermilion)

Warren County: (townships of: Deerfield, Hamilton, Harlan, Salem, Union & Washington) (Clear Creek, Franklin, Mossie, Turtle Creek & Wayne)

Details :

An Abatement Journeyman is anyone who has more than 600 hours in the Asbestos Abatement field.

Asbestos & lead paint abatement including, but not limited to the removal or encapsulation of asbestos & lead paint, all work in conjunction with the preparation of the removal of same & all work in conjunction with the clean up after said removal. The removal of all insulation materials, whether they contain asbestos or not, from mechanical systems (pipes, boilers, ducts, flues, breaching, etc.) is recognized as being the exclusive work of the Asbestos Abatement Workers.

On all mechanical systems (pipes, boilers, ducts, flues, breaching, etc.) that are going to be demolished, the removal of all insulating materials whether they contain asbestos or not shall be the exclusive work of the Laborers.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Asbestos Local 50 Heat & Frost Insulators

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN02-2025ib	Asbestos Worker	7/30/2025	7/30/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Asbestos Insulation Mechanic	$40.56		$9.55	$9.60	$0.55	$0.00	$4.75	$0.00	$0.00	$0.00	$65.01	$85.29
Firestop Technician	$40.56		$9.55	$9.60	$0.55	$0.00	$4.75	$0.00	$0.00	$0.00	$65.01	$85.29
Apprentice	BHR	Percent										
1st year	$25.81	$63.63	$9.55	$4.52	$0.50	$0.00	$0.50	$0.00	$0.00	$0.00	$40.88	$53.78
2nd year	$30.11	$74.23	$9.55	$4.52	$0.50	$0.00	$0.85	$0.00	$0.00	$0.00	$45.53	$60.59
3rd year	$34.41	$84.83	$9.55	$6.76	$0.50	$0.00	$1.25	$0.00	$0.00	$0.00	$52.47	$69.67
4th year	$36.56	$90.13	$9.55	$6.76	$0.50	$0.00	$1.50	$0.00	$0.00	$0.00	$54.87	$73.15

(*)Special Calculation Note :

Ratio :

1 Journeymen to 1 Apprentice
4 Journeymen to 1 Apprentice thereafter

Jurisdiction (* denotes special jurisdictional note) :

Athens, Auglaize, Butler*, Champaign, Clark, Clinton, Crawford, Darke, Delaware, Fairfield, Fayette, Franklin, Greene, Guernsey, Hardin, Hocking, Knox, Licking, Logan, Madison, Marion, Miami, Montgomery, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Preble, Ross, Shelby, Union, Vinton, Warren*

Special Jurisdictional Note :

Butler County: Townships of Lemon and Madison.
Warren County: Township of Clear Creek, Franklin, Massie, Turtle Creek and Wayne

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Boilermaker Local 105

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN02-2013fb	Boilermaker	10/1/2013	10/1/2013

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Boilermaker	$35.26		$7.07	$13.28	$0.89	$0.00	$3.00	$0.55	$0.00	$0.00	$60.05	$77.68
Apprentice	BHR	Percent										
1st 6 months	$24.69	$70.03	$7.07	$11.30	$0.89	$0.00	$2.10	$0.55	$0.00	$0.00	$46.60	$58.95
2nd 6 months	$26.45	$75.02	$7.07	$11.30	$0.89	$0.00	$2.25	$0.55	$0.00	$0.00	$48.51	$61.74
3rd 6 months	$28.21	$80.00	$7.07	$11.30	$0.89	$0.00	$2.40	$0.55	$0.00	$0.00	$50.42	$64.52
4th 6 months	$29.98	$85.02	$7.07	$11.30	$0.89	$0.00	$2.55	$0.55	$0.00	$0.00	$52.34	$67.33
5th 6 months	$30.86	$87.52	$7.07	$13.28	$0.89	$0.00	$2.63	$0.55	$0.00	$0.00	$55.28	$70.71
6th 6 months	$31.74	$90.03	$7.07	$13.28	$0.89	$0.00	$2.70	$0.55	$0.00	$0.00	$56.23	$72.11
7th 6 months	$32.62	$92.50	$7.07	$13.28	$0.89	$0.00	$2.78	$0.55	$0.00	$0.00	$57.19	$73.49
8th 6 months	$33.50	$95.00	$7.07	$13.28	$0.89	$0.00	$2.85	$0.55	$0.00	$0.00	$58.14	$74.89

(*)Special Calculation Note :

Other is Supplemental Health and Welfare

Ratio :

5 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Athens, Brown, Butler, Champaign, Clark, Clermont, Clinton, Fairfield, Fayette, Franklin, Gallia, Greene, Guernsey, Hamilton, Highland, Hocking, Jackson, Lawrence, Licking, Madison, Meigs, Miami, Montgomery, Morgan, Muskingum, Noble, Perry, Pickaway, Pike, Preble, Ross, Scioto, Vinton, Warren

Special Jurisdictional Note :

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Bricklayer Local 23 (Columbus Tile Finisher)

Type of Rate: Commercial

Change #: LCN01-2025ib

Craft: Bricklayer

Effective Date: 6/1/2025

Effective Date: 6/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Bricklayer Tile Marble Finisher	$31.75		$8.72	$3.24	$0.55	$0.00	$0.50	$0.00	$0.00	$0.00	$44.76	$60.64
Terrazzo Finisher	$32.00		$8.72	$3.24	$0.55	$0.00	$0.50	$0.00	$0.00	$0.00	$45.01	$61.01
Floor Grinder	$32.25		$8.72	$3.24	$0.55	$0.00	$0.50	$0.00	$0.00	$0.00	$45.26	$61.39
Base Grinder	$32.50		$8.72	$3.24	$0.55	$0.00	$0.50	$0.00	$0.00	$0.00	$45.51	$61.76
Apprentice	BHR	Percent										
1st Year	$22.23	$70.00	$8.72	$3.24	$0.55	$0.00	$0.50	$0.00	$0.00	$0.00	$35.24	$46.35
2nd Year	$25.40	$80.00	$8.72	$3.24	$0.55	$0.00	$0.50	$0.00	$0.00	$0.00	$38.41	$51.11
3rd Year	$28.58	$90.00	$8.72	$3.24	$0.55	$0.00	$0.50	$0.00	$0.00	$0.00	$41.59	$55.87
Apprentice Improver	$15.88	$50.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$15.88	$23.81

(*)Special Calculation Note :

Ratio :

1-2 Journeymen to 1 Apprentice 3-5Journeymen to 2 Apprentice Crews larger than 5: 4 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Athens, Coshocton, Delaware, Fairfield, Fayette, Franklin, Guernsey, Hocking, Jackson, Knox, Licking, Madison, Meigs, Morgan, Muskingum, Noble, Perry, Pickaway, Pike, Ross, Union, Vinton, Washington

Special Jurisdictional Note :

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Bricklayer Local 23 (Columbus Tile Setter)

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Bricklayer	6/1/2025	6/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Bricklayer Tile Setter	$33.89		$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$52.69	$69.64
Marble Mason	$33.89		$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$52.69	$69.64
Terrazzo Worker	$34.14		$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$52.94	$70.01
Terrazzo Worker, Installation	$34.14		$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$52.94	$70.01
Apprentice	BHR	Percent										
1st Year	$23.72	$70.00	$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$42.52	$54.38
2nd Year	$27.11	$80.00	$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$45.91	$59.47
3rd Year	$30.50	$90.00	$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$49.30	$64.55
4th Year	$32.20	$95.00	$9.47	$7.40	$0.68	$0.00	$1.25	$0.00	$0.00	$0.00	$51.00	$67.09

(*)Special Calculation Note :

Ratio :

1 - 3 Journeyman to 1 Apprentice 4 - 8 Journeyman to 2 Apprentice 9 - 13 Journeyman to 3 Apprentice 14 - 18 Journeyman to 4 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Athens, Coshocton, Delaware, Fairfield, Fayette, Franklin, Guernsey, Hocking, Jackson, Knox, Licking, Madison, Meigs, Morgan, Muskingum, Noble, Perry, Pickaway, Pike, Ross, Union, Vinton, Washington

Special Jurisdictional Note :

Noble County: (Townships of Beaver, Buffalo, Seneca & Wayne)

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Bricklayer Local 23 (Columbus)

Type of Rate: Commercial

Change #: LCN01-2025ib

Craft: Bricklayer

Effective Date: 6/1/2025

Effective Date: 6/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Bricklayer	$37.35		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$58.86	$77.54
Lay Out Man	$37.85		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$59.36	$78.29
Saw Man	$37.85		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$59.36	$78.29
Stone & Cement Mason	$37.35		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$58.86	$77.54
Pointer Caulker Cleaner Block Stone	$37.35		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$58.86	$77.54
Plaster	$37.35		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$58.86	$77.54
Swing Stage (Ground Floors thru 23 Floors)	$38.35		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$59.86	$79.04
Swing Stage (24th Floors and Above	$39.35		$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$60.86	$80.54
Apprentice	BHR	Percent										
1st Year	$26.15	$70.00	$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$47.66	$60.73
2nd Year	$29.88	$80.00	$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$51.39	$66.33
3rd Year	$33.62	$90.00	$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$55.13	$71.93
4th Year	$35.48	$95.00	$10.48	$9.04	$0.74	$0.00	$1.25	$0.00	$0.00	$0.00	$56.99	$74.73
MASON TRAINEES	$	$	$	$	$	$	$	$	$	$	$	$
1-90 Days	$18.68	$50.02	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$18.68	$28.02
90-365 Days	$18.68	$50.02	$10.48	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$29.16	$38.50
2nd Year	$20.54	$55.00	$10.48	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$31.02	$41.29

(*)Special Calculation Note :

No special calculations for this skilled craft wage rate are required at this time.

Ratio :

REQUIRED RATIO 1-2 Journeyman to 1 Apprentice 3- 6 Journeyman to 2 Apprentice 7-10 Journeyman to 3 Apprentice 1-15 Journeyman to 4 Apprentice MASON TRAINEE REQUIRED RATIO 1 Apprentice permits 1 Mason Trainee 2 Apprentice permits 1 Mason Trainee 3 Apprentice permits 2 Mason Trainee 4 Apprentice permits 2 Mason Trainee

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Franklin, Madison, Pickaway, Union

Special Jurisdictional Note :

Details :

MASON TRAINEE: duties shall be to work in all aspects of Masonry construction taking direction from the employer and the Journeyman Bricklayer & Stone Mason's working on the job. MASON TRAINEE may work on job site only when a registered apprentice is on job and the ratios in above table will be strictly enforced. Above Journeyman Rate: Brick Power Saw Pay $.50 Designated layout person $.50 Swingstage Work $1.00 at start,and additional $2.00 at 24th floor

Prevailing Wage Rate
Skilled Crafts

Name of Union: Bricklayer Local 23 Heavy Hwy (A)

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2024ib	Bricklayer	6/5/2024	6/5/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Cement Mason Bricklayer Sewer Water Works A	$33.39		$10.00	$9.53	$0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$53.45	$70.15
Apprentice	BHR	Percent										
1st year	$23.37	$70.00	$10.00	$9.53	$0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$43.43	$55.12
2nd year	$26.71	$80.00	$10.00	$9.53	$0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$46.77	$60.13
3rd year	$30.05	$90.00	$10.00	$9.53	$0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$50.11	$65.14

(*)Special Calculation Note :

NOT FOR BUILDING CONSTRUCTION.

Ratio :

3 Journeymen to 1 Apprentice 6 Journeymen to 2 Apprentice 9 Journeymen to 3 Apprentice 12 Journeymen to 4 Apprentice 15 Journeymen to 5 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Gallia, Geauga, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Lucas, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Portage, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne

Special Jurisdictional Note :

Details :

(A) Highway Construction, Sewer, Waterworks And Utility Construction, Industrial & Building Site Heavy Construction, Airport Construction Or Railroad Construction Work. (B) Power Plant, Tunnels, Amusement Park, Athletic Stadium Site Work ,Pollution Control,Sewer Plant, Waste Plant, & Water Treatment Facilities, Construction.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Bricklayer Local 23 Heavy Hwy (B)

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2024ib	Bricklayer	6/5/2024	6/5/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Cement Mason Bricklayer Power Plants Tunnels Amusement Parks B	$34.39		$10.00	$9.52	$0.54	$0.00	$0.00	$0.00	$0.00	$0.00	$54.45	$71.65
Apprentice	BHR	Percent										
1st year	$24.07	$70.00	$10.00	$9.52	$0.54	$0.00	$0.00	$0.00	$0.00	$0.00	$44.13	$56.17
2nd year	$27.51	$80.00	$10.00	$9.52	$0.54	$0.00	$0.00	$0.00	$0.00	$0.00	$47.57	$61.33
3rd year	$30.95	$90.00	$10.00	$9.52	$0.54	$0.00	$0.00	$0.00	$0.00	$0.00	$51.01	$66.49

(*)Special Calculation Note :

NOT FOR BUILDING CONSTRUCTION.

Ratio :

3 Journeymen to 1 Apprentice 6 Journeymen to 2 Apprentice 9 Journeymen to 2 Apprentice 12 Journeymen to 4 Apprentice 15 Journeymen to 5 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Gallia, Geauga, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Lucas, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Portage, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne

Special Jurisdictional Note :

Details :

(A) Highway Construction, Sewer, Waterworks And Utility Construction, Industrial & Building Site Heavy Construction, Airport Construction Or Railroad Construction Work. (B) Power Plant, Tunnels, Amusement Park, Athletic Stadium Site Work ,Pollution Control,Sewer Plant, Waste Plant, & Water Treatment Facilities, Construction.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Carpenter & Pile Driver Local 200

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Carpenter	5/7/2025	5/7/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Carpenter	$35.94		$8.85	$10.78	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$59.69	$77.66
Pile Driver	$35.69		$8.85	$10.78	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$59.44	$77.29
Apprentice	BHR	Percent										
1st 6 months	$25.16	$70.00	$8.85	$2.00	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$40.13	$52.71
2nd 6 months	$25.16	$70.00	$8.85	$2.00	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$40.13	$52.71
3rd 6 months	$28.75	$80.00	$8.85	$8.62	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$50.34	$64.72
4th 6 months	$28.75	$80.00	$8.85	$8.62	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$50.34	$64.72
5th 6 months	$32.35	$90.00	$8.85	$9.70	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$55.02	$71.19
6th 6 months	$32.35	$90.00	$8.85	$9.70	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$55.02	$71.19
7th 6 months	$34.14	$95.00	$8.85	$10.24	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$57.35	$74.42
8th 6 months	$34.14	$95.00	$8.85	$10.24	$0.70	$0.00	$3.26	$0.16	$0.00	$0.00	$57.35	$74.42

(*)Special Calculation Note :

Other is UBC National Fund.

Ratio :

1 Journeyman to 1 Apprentice Thereafter 2 Journeyman to 1 Apprentice The first carpenter on the job shall be a journeyman. The second carpenter employed may be an apprentice carpenter. After one (1) journeyman and one (1) apprentice are employed, each employer shall employ a ratio of one (1) apprentice, when avilable, to two (2) journeyman.

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Franklin, Guernsey, Licking, Madison, Marion, Muskingum, Morgan, Noble, Perry, Pickaway, Union

Special Jurisdictional Note :

Details :

CARPENTERS duties shall include but not limited to the milling, fashioning, joining, assembling, erecting, fastening, or dismantling of scaffolding and of material of wood, plastic, metal, fiber, cork and composition, and all other substitute materials. The handling, cleaning, erecting, installing and dismantling of machinery, equipment and all materials used by carpenters. The building and setting of all concrete forms and decking, and dismantling the same; the setting of templates for anchor bolts for structural members and for machinery, and the placing, leveling and bracing of these bolts; the making of all forms for bulkheads, figures, post, balusters and ornaments. The erection and installation of cooling towers assembled onsite. The building of all barricades and handling of rough lumber and drywall. The installation of all required blocking and all toilet accessories, including but not limited to grab bars, napkin dispensers and receptacles, mirrors and soap dispensers. The installation of metal studs and the welding of studs and other fastenings to receive material being applied by carpenters. The installation of all material used in drywall construction such as plasterboard, transite and other composition boards. The installation of carpet, artificial turf, wood and Resilient floors shall consist of and include the laying of all special designs of wood, wood block, wood composition, cork, linoleum, asphalt, mastic, plastic and rubber tile, whether nailed or laid in, or with linoleum paste or glue compositions. The installation of garage and overhead doors. The installation of fixtures, cabinets, shelving, racks, louvers, etc. The assembling and setting of all seats in theaters, halls, churches, schools, auditoriums, grandstands and other buildings. Our claim of jurisdiction, therefore, extends over the following subdivisions of the trade. Carpenters and Joiners; Bridge, Dock and Wharf Carpenters, Divers, Underpinners, Timbermen and Core Drillers; Shipwrights, Boat Builders, Ship Carpenters, Joiners and Caulkers, Cabinet Makers, Bench Hands, Stair Builders; Millmen; Wood and Resilient Floor Layers and Finishers; Carpet Layers; Shinglers; Siders; Insulators; Acoustic and Drywall Applicators; Shorers and House Movers; Loggers; Lumber and Sawmill Workers; Furniture Workers; Reed and Rattan Workers; Shingle Weavers; Casket and Coffin Makers; Box Makers; Railroad Carpenters; and Car Builders, regardless of material used; and all those engaged in the operation of woodworking or other machinery required in the fashioning, milling or manufacturing of products used in the trade, or engaged as helpers to any of the above divisions or subdivisions, and the handling, erecting and installing of material on any of the above divisions or subdivisions; burning welding, rigging and the use of any instrument or tool for layout work incidental to the trade. When the term “Carpenter” and “Joiner” is used, it shall mean all the subdivisions of the trade. PILEDRIVER: Where piling is used in the construction and repair of all wharves, docks, piers, trestles, caissons, cofferdams, the erection of all sea walls and breakwaters. The placing of all walling, bumper guards of wood or metal. The framing, boring, drilling or burning of all holes in the same, all tie and hog rods in connection with Piledrivers work. The driving, bracing, plumbing, cutting-off and capping of all piling whether wood, steel sheeting, metal pipe piling, composite or concrete. The heading and splicing of wood piling and the making of woodsheet piling, The welding, cutting or burning of any metal and wood piling and shoring and underpinning in connection with Piledriver work. The loading and unloading of all piling and other material used in connection with Piledrivers work. The loading, unloading, erecting, framing, dismantling, moving and handling of all drivers, derrick, cranes and other piledriving equipment used in the work. Drilling in piling or drilled in caissons where a steel liner is used. All machinery used for handling spuds or anchors on floating equipment used in our work shall be operated by our members. Where swing lines or derricks are used, members shall be used as watchmen. All underwater and marine work on all bulkheads, wharves, docks, shipyards, caissons, piers, bridges, pipeline work, viaducts, marine cable and trestles, as well as salvage and reclamation work where divers are employed. All clamming work that is done by floating derricks.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Carpenter & Piledriver SC District HevHwy

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCR01-2025ib	Carpenter	7/9/2025	7/9/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Journeyman	$35.69		$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$59.09	$76.94
Apprentice	BHR	Percent										
1st 6 months	$24.98	$70.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$48.38	$60.87
2nd 6 months	$24.98	$70.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$48.38	$60.87
3rd 6 months	$28.55	$80.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$51.95	$66.23
4th 6 months	$28.55	$80.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$51.95	$66.23
5th 6 months	$32.12	$90.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$55.52	$71.58
6th 6 months	$32.12	$90.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$55.52	$71.58
7th 6 months	$33.91	$95.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$57.31	$74.26
8th 6 months	$33.91	$95.00	$8.85	$10.78	$0.70	$0.00	$2.91	$0.16	$0.00	$0.00	$57.31	$74.26

(*)Special Calculation Note :

Other: UBC National Fund

When the contractor furnishes the necessary underwater gear for the diver, the diver shall be paid one and one half (1 & 1/2) times the journeyman rate for the time spent in the water.

Ratio :

1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Athens, Delaware, Fairfield, Fayette, Franklin, Gallia, Guernsey, Highland, Hocking, Jackson, Lawrence, Licking, Madison, Marion, Meigs, Morgan, Muskingum, Noble, Perry, Pickaway, Pike, Ross, Scioto, Union, Vinton, Washington

Special Jurisdictional Note :

Details :

**Highway Construction, Airport Construction, Heavy Construction but not limited to: Tunnels, subways, drainage projects, flood control, reservoirs

Railroad Construction, Sewer Waterworks & Utility Construction but not limited to: storm sewers, waterlines, gas lines

Industrial & Building site, Power Plant, Amusement Park, Athletic stadium site, Sewer and Water Plants.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Carpenter Millwright Local 1090 Columbus

Type of Rate: Commercial

Change #:
LCN01-2025ib

Craft:
Carpenter

Effective Date:
5/13/2025

Effective Date:
5/13/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Carpenter Millwright	$35.59		$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$63.49	$81.29
Apprentice	BHR	Percent										
1st 6 months	$24.91	$70.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$52.81	$65.27
2nd 6 months	$24.91	$70.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$52.81	$65.27
3rd 6 months	$28.47	$80.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$56.37	$70.61
4th 6 months	$28.47	$80.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$56.37	$70.61
5th 6 months	$32.03	$90.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$59.93	$75.95
6th 6 months	$32.03	$90.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$59.93	$75.95
7th 6 months	$33.81	$95.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$61.71	$78.62
8th 6 months	$33.81	$95.00	$8.85	$10.99	$0.70	$0.00	$7.20	$0.16	$0.00	$0.00	$61.71	$78.62

(*)Special Calculation Note :

Other is for UBC National Fund.

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Franklin, Guernsey, Licking, Madison, Marion, Morgan, Muskingum, Noble, Perry, Pickaway, Union

Special Jurisdictional Note :

Details :

The term “Millwright and Machine Erectors”’ jurisdiction shall mean the unloading, hoisting, rigging, skidding, moving, dismantling, aligning, erecting, assembling, repairing, maintenance and adjusting of all structures, processing areas either under cover, underground or elsewhere, required to process material, handle, manufacture or service, be it powered or receiving power manually, by steam, gas, electricity, gasoline, diesel, nuclear, solar, water, air or chemically, and in industries such as and including, which are identified for the purpose of description, but not limited to, the following: woodworking plants; canning industries; steel mills; coffee roasting plants; paper and pulp; cellophane; stone crushing; gravel and sand washing and handling; refineries; grain storage and handling; asphalt plants; sewage disposal; water plants; laundries; bakeries; mixing plants; can, bottle and bag packing plants; textile mills; paint mills; breweries; milk processing plants; power plants; aluminum processing or manufacturing plants; and amusement and entertainment fields. The installation of mechanical equipment in atomic energy plants; installation of reactors in power plants; installation of control rods and equipment in reactors; and installation of mechanical equipment in rocket missile bases, launchers, launching gantry, floating bases, hydraulic escape doors and any and all component parts thereto, either assembled, semi-assembled or disassembled. The installation of, but not limited to, the following: setting-up of all engines, motors, generators, air compressors, fans, pumps, scales, hoppers, conveyors of all types, sizes and their supports; escalators; man lifts; moving sidewalks; hosts; dumb waiters; all types of feeding machinery; amusement devices; mechanical pin setters and spotters in bowling alleys; refrigeration equipment; and the installation of all types of equipment necessary and required to process material either in the manufacturing or servicing. The handling and installation of pulleys, gears, sheaves, fly wheels, air and vacuum drives, worm drives and gear drivers directly or indirectly coupled to motors, belts, chains, screws, legs, boots, guards, booth tanks, all bin valves, turn heads and indicators, shafting, bearings, cable sprockets cutting all key seats in new and old work, troughs, chippers, filters, calendars, rolls, winders, rewinders, slitters, cutters, wrapping machines, blowers, forging machines, rams, hydraulic or otherwise, planning, extruder, ball, dust collectors, equipment in meat packing plants, splicing or ropes and cables. The laying-out, fabrication and installation of protection equipment including machinery guards, making and setting of templates for machinery, fabrication of bolts, nuts, pans, dripping of holes for any equipment which the Millwrights install regardless of materials; all welding and burning regardless of type, fabrication of all lines, hose or tubing used in lubricating machinery installed by Millwrights; grinding, cleaning, servicing and any machine work necessary for any part of any equipment installed by the Millwrights; and the break-in and trail run of any equipment or machinery installed by the Millwrights. It is agreed the Millwrights shall use the layout tools and optic equipment necessary to perform their work.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Cement Mason Local 132 (Columbus)

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Cement Mason	6/4/2025	6/4/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Cement Mason	$35.12		$8.90	$4.65	$0.75	$0.00	$3.10	$0.06	$0.00	$0.00	$52.58	$70.14
Apprentice	BHR	Percent										
1st Year	$24.58	$70.00	$8.90	$4.65	$0.75	$0.00	$3.10	$0.06	$0.00	$0.00	$42.04	$54.34
2nd Year	$28.10	$80.00	$8.90	$4.65	$0.75	$0.00	$3.10	$0.06	$0.00	$0.00	$45.56	$59.60
3rd Year	$31.61	$90.00	$8.90	$4.65	$0.75	$0.00	$3.10	$0.06	$0.00	$0.00	$49.07	$64.87

(*)Special Calculation Note :

Other: International Training Fund

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Ashland, Coshocton, Crawford, Delaware, Fairfield, Fayette, Franklin, Guernsey, Hocking, Knox, Licking, Madison, Marion, Morrow, Muskingum, Perry, Pickaway, Richland, Ross, Union, Vinton, Wyandot

Special Jurisdictional Note :

Details :

Working on swing stage, slip scaffold, window jack scaffold, scissor lifts, and aerial lifts shall receive the following rates: $.50 above the regular rate for heights up to fifty (50) feet above grade level $1.00 above the regular rate for heights over fifty (50) feet above grade level

Prevailing Wage Rate
Skilled Crafts

Name of Union: Cement Mason Local 132 Hev Hwy (Columbus)

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Cement Mason	5/1/2025	5/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Cement Mason	$37.29		$9.00	$7.65	$0.75	$0.00	$2.40	$0.07	$0.00	$0.00	$57.16	$75.81
Apprentice	BHR	Percent										
1st Year	$26.10	$70.00	$9.00	$7.65	$0.75	$0.00	$2.40	$0.07	$0.00	$0.00	$45.97	$59.02
2nd Year	$29.83	$80.00	$9.00	$7.65	$0.75	$0.00	$2.40	$0.07	$0.00	$0.00	$49.70	$64.62
3rd Year	$33.56	$90.00	$9.00	$7.65	$0.75	$0.00	$2.40	$0.07	$0.00	$0.00	$53.43	$70.21

(*)Special Calculation Note :

Other: International Training Fund

Ratio :

1 Journeyman to 1 Apprentice 2 Journeymen to 1 Apprentice thereafter

Jurisdiction (* denotes special jurisdictional note) :

Ashland, Athens, Coshocton, Crawford, Delaware, Fairfield, Fayette, Franklin, Guernsey, Hocking, Knox, Licking, Madison, Marion, Meigs, Monroe, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Richland, Ross, Union, Vinton, Washington, Wyandot

Special Jurisdictional Note :

Details :

Highway Construction, Sewer, Waterworks And Utility Construction, Industrial & Building Site, Heavy Construction, Airport Construction Or Railroad Construction Work, Power Plant, Tunnels, Amusement Park, Athletic Stadium Site Work, Pollution Control, Sewer Plant, Waste & Water Plant, Water Treatment Facilities Construction.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 683 Inside

Type of Rate: Commercial

Change #: LCN02-2025ib

Craft: Electrical

Effective Date: 8/13/2025

Effective Date: 8/13/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrician	$43.00		$12.15	$8.81	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$69.37	$90.87
Welding	$44.00		$12.15	$8.84	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$70.40	$92.40
Medium Voltage Splicing	$44.00		$12.15	$8.84	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$70.40	$92.40
Over 100 feet	$64.50		$12.15	$9.46	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$91.52	$123.7
Level 1 CW 0 to 2000 hours	$15.29		$6.83	$0.46	$0.92	$0.00	$0.46	$0.10	$0.00	$0.00	$24.06	$31.71
Level 2 CW 2001 to 4000 hours	$16.25		$6.83	$0.49	$0.92	$0.00	$0.49	$0.10	$0.00	$0.00	$25.08	$33.21
Level 3 CW 4001 to 6000 hours	$17.20		$6.83	$0.52	$0.92	$0.00	$0.52	$0.10	$0.00	$0.00	$26.09	$34.69
Level 4 CW 6001 to 8000 hours	$19.12		$6.83	$0.57	$0.92	$0.00	$0.57	$0.10	$0.00	$0.00	$28.11	$37.67
Level 1 CE 8001 to 10000 hours	$21.03		$6.83	$0.63	$0.92	$0.00	$0.63	$0.10	$0.00	$0.00	$30.14	$40.66
Level 2 CE 10,001 to 12,000 hours	$22.94		$6.83	$0.69	$0.92	$0.00	$0.69	$0.10	$0.00	$0.00	$32.17	$43.64
Level 3 CE 12,001 to14,000 hours	$28.67		$6.83	$0.86	$0.92	$0.00	$0.86	$0.10	$0.00	$0.00	$38.24	$52.58
Apprentice	BHR	Percent										
0-1000 hrs 1st Period	$21.50	$50.00	$12.15	$4.41	$1.16	$0.00	$0.00	$0.00	$0.00	$0.00	$39.22	$49.97
1001-2000 hrs 2nd Period	$23.65	$55.00	$12.15	$4.85	$1.16	$0.00	$0.00	$0.00	$0.00	$0.00	$41.81	$53.63
2001-3500 hrs 3rd Period	$25.80	$60.00	$12.15	$5.28	$1.16	$0.00	$2.55	$0.00	$0.00	$0.00	$46.94	$59.84
3501-5000 hrs 4th Period	$27.95	$65.00	$12.15	$5.73	$1.16	$0.00	$2.76	$0.00	$0.00	$0.00	$49.75	$63.73
5001-6500 hrs 5th Period	$30.10	$70.00	$12.15	$6.16	$1.16	$0.00	$2.98	$0.00	$0.00	$0.00	$52.55	$67.60

6501-8000 hrs 6th Period	$34.40	$80.00	$12.15	$7.05	$1.16	$0.00	$3.40	$0.00	$0.00	$0.00	$58.16	$75.36

(*)Special Calculation Note :

Other for CW/CE: Education Fund

Ratio :

1 to 3 Journeymen to 2 Apprentices
4 to 6 Journeymen to 4 Apprentices

Construction Wireman and Construction Electrician Ratio:
1 Journeymen to 4 (CW/CE) Employees
An Inside Journeyman Wireman is required on the project at the 5th worker or when apprentices are used.

Jurisdiction (* denotes special jurisdictional note) :

Champaign, Clark, Delaware, Fairfield, Franklin, Madison, Pickaway*, Union

Special Jurisdictional Note :

In Pickaway County the following townships: Circleville, Darby, Harrison, Jackson, Madison, Monroe, Muhlenberg, Scioto, Walnut, Washington.

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 683 Inside Lt Commercial South West

Type of Rate: Commercial

Change #: LCN02-2025ib

Craft: Electrical

Effective Date: 8/13/2025

Effective Date: 8/13/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrician	$43.00		$12.15	$8.81	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$69.37	$90.87
Welding	$44.00		$12.15	$8.84	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$70.40	$92.40
Medium Voltage Splicing	$44.00		$12.15	$8.84	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$70.40	$92.40
Over 100 feet	$64.50		$12.15	$9.46	$1.16	$0.00	$4.25	$0.00	$0.00	$0.00	$91.52	$123.7
Level 1 CW 0 to 2000 hours	$15.29		$6.83	$0.46	$0.92	$0.00	$0.46	$0.10	$0.00	$0.00	$24.06	$31.71
Level 2 CW 2001 to 4000 hours	$16.25		$6.83	$0.49	$0.92	$0.00	$0.49	$0.10	$0.00	$0.00	$25.08	$33.21
Level 3 CW 4001 to 6000 hours	$17.20		$6.83	$0.52	$0.92	$0.00	$0.52	$0.10	$0.00	$0.00	$26.09	$34.69
Level 4 CW 6001 to 8000 hours	$19.12		$6.83	$0.57	$0.92	$0.00	$0.57	$0.10	$0.00	$0.00	$28.11	$37.67
Level 1 CE 8001 to 10000 hours	$21.03		$6.83	$0.63	$0.92	$0.00	$0.63	$0.10	$0.00	$0.00	$30.14	$40.66
Level 2 CE 10,001 to 12,000 hours	$22.94		$6.83	$0.69	$0.92	$0.00	$0.69	$0.10	$0.00	$0.00	$32.17	$43.64
Level 3 CE 12,001 to14,000 hours	$28.67		$6.83	$0.86	$0.92	$0.00	$0.86	$0.10	$0.00	$0.00	$38.24	$52.58
Apprentice	BHR	Percent										
0-1000 hrs 1st Period	$21.50	$50.00	$12.15	$4.41	$1.16	$0.00	$0.00	$0.00	$0.00	$0.00	$39.22	$49.97
1001-2000 hrs 2nd Period	$23.65	$55.00	$12.15	$4.85	$1.16	$0.00	$0.00	$0.00	$0.00	$0.00	$41.81	$53.63
2001-3500 hrs 3rd Period	$25.80	$60.00	$12.15	$5.28	$1.16	$0.00	$2.55	$0.00	$0.00	$0.00	$46.94	$59.84
3501-5000 hrs 4th Period	$27.95	$65.00	$12.15	$5.73	$1.16	$0.00	$2.76	$0.00	$0.00	$0.00	$49.75	$63.73
5001-6500 hrs 5th Period	$30.10	$70.00	$12.15	$6.16	$1.16	$0.00	$2.98	$0.00	$0.00	$0.00	$52.55	$67.60

6501-8000 hrs 6th Period	$34.40	$80.00	$12.15	$7.05	$1.16	$0.00	$3.40	$0.00	$0.00	$0.00	$58.16	$75.36

(*)Special Calculation Note :

Other for CW/CE: Education Fund

Ratio :

1 to 3 Journeymen to 2 Apprentices
4 to 6 Journeymen to 4 Apprentices

Construction Wireman and Construction Electrician Ratio:
1 Journeymen to 4 (CW/CE) Employees
An Inside Journeyman Wireman is required on the project at the 5th worker or when apprentices are used.

Jurisdiction (* denotes special jurisdictional note) :

Champaign, Clark, Delaware, Fairfield, Franklin, Madison, Pickaway*, Union

Special Jurisdictional Note :

In Pickaway County the following townships: Circleville, Darby, Harrison, Jackson, Madison, Monroe, Muhlenberg, Scioto, Walnut, Washington.

Details :

The scope of work for the light commercial agreement shall apply to the following facilities not to exceed 200,000 square feet; office buildings, shopping centers, auto sales agencies and garages, churches, funeral homes, nursing homes, hotels, retail and wholesale facilities, small stand-alone manufacturing facilities when free standing and not part of a larger facility (not to exceed 50,000 square fee), solar projects (500 panels or less) unless otherwise covered under the agreement, lighting retrofits (when not associated with remodels involving branch re-circuiting) lighting retrofits shall be defined as the changing of lamps and ballasts in existing light fixtures and shall also include the one for one replacement of existing fixtures, warehouses, gas stations, food service centers, restaurants, entertainment facilities, hospitals, clinics, motels, residential buildings.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 683 Voice Data Video

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Electrical	8/13/2025	8/13/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrical Installer Technician B	$32.00		$10.62	$4.46	$0.80	$0.00	$3.00	$0.74	$0.00	$0.00	$51.62	$67.62
Installer Technician A	$33.50		$10.62	$4.51	$0.80	$0.00	$3.00	$0.77	$0.00	$0.00	$53.20	$69.95
Cable Puller	$16.00		$10.62	$0.48	$0.80	$0.00	$3.00	$0.37	$0.00	$0.00	$31.27	$39.27
Apprentice	BHR	Percent										
1st Period 0 - 1000 hours	$19.20	$60.00	$10.62	$4.08	$0.80	$0.00	$3.00	$0.44	$0.00	$0.00	$38.14	$47.74
2nd Period 1001 - 2000 hours	$20.80	$65.00	$10.62	$4.12	$0.80	$0.00	$3.00	$0.48	$0.00	$0.00	$39.82	$50.22
3rd Period 2001 - 3000 hours	$22.40	$70.00	$10.62	$4.17	$0.80	$0.00	$3.00	$0.52	$0.00	$0.00	$41.51	$52.71
4th Period 3001 - 4000 hours	$24.00	$75.00	$10.62	$4.22	$0.80	$0.00	$3.00	$0.55	$0.00	$0.00	$43.19	$55.19
5th Period 4001 - 5000 hours	$25.60	$80.00	$10.62	$4.27	$0.80	$0.00	$3.00	$0.59	$0.00	$0.00	$44.88	$57.68
6th Period 5001 - 6000 hours	$27.20	$85.00	$10.62	$4.32	$0.80	$0.00	$3.00	$0.63	$0.00	$0.00	$46.57	$60.17

(*)Special Calculation Note :

Other is Holiday Pay

Ratio :

1 Apprentice for every 1 Installer Technician
Cable Pullers can only be employed after an apprentice is employed on the job

Jurisdiction (* denotes special jurisdictional note) :

Champaign, Clark, Delaware, Fairfield, Franklin, Madison, Pickaway*, Union

Special Jurisdictional Note :

In Pickaway County the following townships: Circleville, Darby, Harrison, Jackson, Madison, Monroe, Muhlenberg, Scioto, Walnut, Washington.

Details :

An employee who is required to wear an electronic device after hours will receive an additional 1.00 per hour for all hours worked.

HOLIDAYS: Memorial Day, 4th of July, Labor Day, Thanksgiving Day, Christmas Day, New Years Day.

The following work is EXCLUDED from the Teledata Technician work scope: - Installation of computer systems in industrial applications such as assembly lines, robotics, computer controller manufacturing systems. - Installation of conduit &/or raceways shall be installed by Inside Wireman . On sites where there is no Inside Wireman employed, the Teledata Technician may install raceway, or conduit not greater than 10 foot. - Fire Alarm work is excluded on all new construction sites or wherever the fire alarm system is installed in conduit - All HVAC control work. TECHNICIAN (A) is a Technician B who holds a current Technician Certification from BICSI (Building Industry Consulting Service International, Inc.)

CABLE PULLERS are for the installation of cable from one termination point to another.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 71 High Tension Pipe Type Cable

Type of Rate: Commercial

Change #: LCN02-2024ib

Craft: Electrical

Effective Date: 1/6/2025

Effective Date: 1/6/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrical Lineman	$52.94		$7.50	$1.59	$0.53	$0.00	$12.71	$0.75	$0.00	$0.00	$76.02	$102.4
Certified Lineman Welder	$52.94		$7.50	$1.59	$0.53	$0.00	$12.71	$0.75	$0.00	$0.00	$76.02	$102.49
Certified Cable Splicer	$52.94		$7.50	$1.59	$0.53	$0.00	$12.71	$0.75	$0.00	$0.00	$76.02	$102.49
Operator A	$47.43		$7.50	$1.42	$0.47	$0.00	$11.38	$0.75	$0.00	$0.00	$68.95	$92.67
Operator B	$41.99		$7.50	$1.26	$0.42	$0.00	$10.08	$0.75	$0.00	$0.00	$62.00	$83.00
Operator C	$33.74		$7.50	$1.01	$0.34	$0.00	$8.10	$0.75	$0.00	$0.00	$51.44	$68.31
Groundman 0-12 months Exp	$26.47		$7.50	$0.79	$0.26	$0.00	$6.35	$0.75	$0.00	$0.00	$42.12	$55.36
Groundman 0-12 months Exp w/CDL	$29.12		$7.50	$0.87	$0.29	$0.00	$6.99	$0.75	$0.00	$0.00	$45.52	$60.08
Groundman 1 yr or more	$29.12		$7.50	$0.87	$0.29	$0.00	$6.99	$0.75	$0.00	$0.00	$45.52	$60.08
Groundman 1 yr or more w/CDL	$34.41		$7.50	$1.03	$0.34	$0.00	$8.26	$0.75	$0.00	$0.00	$52.29	$69.50
Equipment Mechanic A	$41.99		$7.50	$1.26	$0.42	$0.00	$10.08	$0.75	$0.00	$0.00	$62.00	$83.00
Equipment Mechanic B	$37.86		$7.50	$1.14	$0.38	$0.00	$9.09	$0.75	$0.00	$0.00	$56.72	$75.65
Equipment Mechanic C	$33.74		$7.50	$1.01	$0.34	$0.00	$8.10	$0.75	$0.00	$0.00	$51.44	$68.31
X-Ray Technician	$52.94		$7.50	$1.59	$0.53	$0.00	$12.71	$0.75	$0.00	$0.00	$76.02	$102.49
Apprentice	BHR	Percent										
1st 1000 hrs	$31.76	$60.00	$7.50	$0.95	$0.32	$0.00	$7.62	$0.75	$0.00	$0.00	$48.90	$64.79
2nd 1000 hrs	$34.41	$65.00	$7.50	$1.03	$0.34	$0.00	$8.26	$0.75	$0.00	$0.00	$52.29	$69.50
3rd 1000 hrs	$37.06	$70.00	$7.50	$1.11	$0.37	$0.00	$8.89	$0.75	$0.00	$0.00	$55.68	$74.21

4th 1000 hrs	$39.71	$75.00	$7.50	$1.19	$0.40	$0.00	$9.53	$0.75	$0.00	$0.00	$59.08	$78.93
5th 1000 hrs	$42.35	$80.00	$7.50	$1.27	$0.42	$0.00	$10.16	$0.75	$0.00	$0.00	$62.45	$83.63
6th 1000 hrs	$45.00	$85.00	$7.50	$1.35	$0.45	$0.00	$10.80	$0.75	$0.00	$0.00	$65.85	$88.35
7th 1000 hrs	$47.65	$90.00	$7.50	$1.43	$0.48	$0.00	$11.44	$0.75	$0.00	$0.00	$69.25	$93.07

(*)Special Calculation Note :

Other is Health Retirement Account Operator "A" John Henry Rock Drill, D-6 (or equivalent) and above, Trackhoe Digger, (320 Track excavator), Cranes (greater then 25 tons and less than 45 tons). Operator "B" Cranes (greater than 6 tons and up to 25 tons), Backhoes, Road Tractor, Dozer up to D-5, Pressure Digger- wheeled or tracked, all Tension wire Stringing equipment. Operator "C" Trench, Backhoe, Riding type vibratory Compactor, Ground Rod Driver, Boom Truck (6 ton & below), Skid Steer Loaders, Material Handler. *All Operators of cranes 45 ton or larger shall be paid the journeyman rate of pay. $0.30 is for Health Retirement Account.

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Delaware, Fairfield, Fayette, Franklin, Gallia, Geauga, Greene, Guernsey, Hamilton, Harrison, Highland, Hocking, Holmes, Jackson, Jefferson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Pike, Portage, Preble, Richland, Ross, Scioto, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Vinton, Warren, Washington, Wayne

Special Jurisdictional Note :

Details :

Heli - Arc Welding will be paid $.30 above Journeyman rate. Additional compensation of 10% over the Journeyman Lineman and Journeyman Technician for performing work on structures outside of buildings such as water towers, smoke stacks, radio and television towers, more than 75' above the ground.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 71 Outside (Central OH Chapter)

Type of Rate: Commercial

Change #: LCN01-2025ib

Craft: Electrical

Effective Date: 6/4/2025

Effective Date: 6/4/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrical Lineman	$46.03		$7.50	$1.38	$0.46	$0.00	$9.20	$0.50	$0.00	$0.00	$65.07	$88.09
Traffic Signal & Lighting Journeyman	$44.43		$7.50	$1.33	$0.44	$0.00	$8.89	$0.50	$0.00	$0.00	$63.09	$85.31
Equipment Operator	$40.44		$7.50	$1.21	$0.40	$0.00	$8.09	$0.50	$0.00	$0.00	$58.14	$78.36
Groundman 0-12 months (W/O CDL)	$24.52		$7.50	$0.74	$0.25	$0.00	$4.90	$0.50	$0.00	$0.00	$38.41	$50.67
Groundman 0-12 Months W/CDL	$26.78		$7.50	$0.80	$0.27	$0.00	$5.36	$0.50	$0.00	$0.00	$41.21	$54.60
Groundman greater than 1 Year W/CDL	$29.07		$7.50	$0.87	$0.29	$0.00	$5.81	$0.50	$0.00	$0.00	$44.04	$58.58
Traffic Signal Apprentices	$		$	$	$	$	$	$	$	$	$	$
1st 1,000 hours	$26.66		$7.50	$0.80	$0.27	$0.00	$5.33	$0.50	$0.00	$0.00	$41.06	$54.39
2nd 1,000 hours	$28.88		$7.50	$0.87	$0.29	$0.00	$5.78	$0.50	$0.00	$0.00	$43.82	$58.26
3rd 1,000 hours	$31.10		$7.50	$0.93	$0.31	$0.00	$6.22	$0.50	$0.00	$0.00	$46.56	$62.11
4th 1,000 hours	$33.32		$7.50	$1.00	$0.33	$0.00	$6.66	$0.50	$0.00	$0.00	$49.31	$65.97
5th 1,000 hours	$35.54		$7.50	$1.07	$0.36	$0.00	$7.11	$0.50	$0.00	$0.00	$52.08	$69.85
6th 1,000 hours	$39.99		$7.50	$1.20	$0.40	$0.00	$8.00	$0.50	$0.00	$0.00	$57.59	$77.59
Apprentice	BHR	Percent										
1st 1,000 Hours	$27.62	$60.00	$7.50	$0.83	$0.28	$0.00	$5.52	$0.50	$0.00	$0.00	$42.25	$56.06
2nd 1,000 Hours	$29.92	$65.00	$7.50	$0.90	$0.30	$0.00	$5.98	$0.50	$0.00	$0.00	$45.10	$60.06
3rd 1,000 Hours	$32.22	$70.00	$7.50	$0.97	$0.32	$0.00	$6.44	$0.50	$0.00	$0.00	$47.95	$64.06
4th 1,000 Hours	$34.52	$75.00	$7.50	$1.04	$0.35	$0.00	$6.90	$0.50	$0.00	$0.00	$50.81	$68.07

5th 1,000 Hours	$36.82	$80.00	$7.50	$1.10	$0.37	$0.00	$7.36	$0.50	$0.00	$0.00	$53.65	$72.07
6th 1,000 Hours	$39.13	$85.00	$7.50	$1.17	$0.39	$0.00	$7.82	$0.50	$0.00	$0.00	$56.51	$76.07
7th 1,000 Hours	$41.43	$90.00	$7.50	$1.24	$0.41	$0.00	$8.28	$0.50	$0.00	$0.00	$59.36	$80.07

(*)Special Calculation Note :

Other is Health Reimburstment Account

Ratio :

1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Ashland, Athens, Coshocton, Crawford, Delaware, Fairfield, Fayette, Franklin, Gallia, Guernsey, Highland, Hocking, Jackson, Knox, Lawrence, Licking, Madison, Marion, Meigs, Monroe, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Pike, Richland, Ross, Scioto, Tuscarawas, Union, Vinton, Washington

Special Jurisdictional Note :

Details :

A groundman when directed shall assist a Journeyman Lineman, Traffic Signal and Lighting Journeyman or Equipment Operator in the performance of his/her work on the ground, including the use of hand tools. Under no circumstances shall this classification climb poles, towers, or work from an elevated platform or bucket truck. This classification shall not perform work normally assigned to an Apprentice. No more than three (3) Groundmen shall work alone. Jobs with more that three Groundmen shall be supervised by a Groundcrew Foreman, Journeyman Lineman, Journeyman Traffic Signal Technician or an Equipment Operator. Scope of Work: installation and maintenance of highway and street lighting, highway and street sign lighting, electronic message boards and traffic control systems, camera systems, traffic signal work, substation and line construction including overhead and underground projects for private and industrial work as in accordance with the IBEW Constitution. This Agreement includes the operation of all tools and equipment necessary for the installation of the above projects.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 71 Outside Utility Power

Type of Rate: Commercial

Change #: LCN01-2024ib

Craft: Electrical

Effective Date: 1/6/2025

Effective Date: 1/6/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrical Lineman	$50.15		$7.50	$1.50	$0.50	$0.00	$12.04	$0.75	$0.00	$0.00	$72.44	$97.52
Substation Technician	$50.15		$7.50	$1.50	$0.50	$0.00	$12.04	$0.75	$0.00	$0.00	$72.44	$97.52
Cable Splicer	$52.52		$7.50	$1.58	$0.52	$0.00	$12.60	$0.75	$0.00	$0.00	$75.47	$101.7
Operator A	$44.95		$7.50	$1.35	$0.45	$0.00	$10.79	$0.75	$0.00	$0.00	$65.79	$88.27
Operator B	$39.73		$7.50	$1.19	$0.40	$0.00	$9.53	$0.75	$0.00	$0.00	$59.10	$78.97
Operator C	$31.89		$7.50	$0.96	$0.32	$0.00	$7.65	$0.75	$0.00	$0.00	$49.07	$65.02
Groundman 0-12 months Exp	$25.07		$7.50	$0.75	$0.25	$0.00	$6.02	$0.75	$0.00	$0.00	$40.34	$52.88
Groundman 0-12 months Exp w/CDL	$27.58		$7.50	$0.83	$0.28	$0.00	$6.62	$0.75	$0.00	$0.00	$43.56	$57.35
Groundman 1 yr or more	$27.58		$7.50	$0.83	$0.28	$0.00	$6.62	$0.75	$0.00	$0.00	$43.56	$57.35
Groundman 1 yr or more w/CDL	$32.60		$7.50	$0.98	$0.33	$0.00	$7.82	$0.75	$0.00	$0.00	$49.98	$66.28
Equipment Mechanic A	$39.73		$7.50	$1.19	$0.40	$0.00	$9.54	$0.75	$0.00	$0.00	$59.11	$78.98
Equipment Mechanic B	$35.82		$7.50	$1.07	$0.36	$0.00	$8.60	$0.75	$0.00	$0.00	$54.10	$72.01
Equipment Mechanic C	$31.89		$7.50	$0.96	$0.32	$0.00	$7.65	$0.75	$0.00	$0.00	$49.07	$65.02
Line Truck w/uuger	$35.16		$7.50	$1.05	$0.35	$0.00	$8.44	$0.75	$0.00	$0.00	$53.25	$70.83
Apprentice	BHR	Percent										
1st 1000 hrs	$30.09	$60.00	$7.50	$0.90	$0.30	$0.00	$7.22	$0.75	$0.00	$0.00	$46.76	$61.81
2nd 1000 hrs	$32.60	$65.00	$7.50	$0.98	$0.33	$0.00	$7.82	$0.75	$0.00	$0.00	$49.98	$66.28
3rd 1000 hrs	$35.11	$70.00	$7.50	$1.05	$0.35	$0.00	$8.43	$0.75	$0.00	$0.00	$53.19	$70.74

4th 1000 hrs	$37.61	$75.00	$7.50	$1.13	$0.38	$0.00	$9.03	$0.75	$0.00	$0.00	$56.40	$75.21
5th 1000 hrs	$40.12	$80.00	$7.50	$1.20	$0.40	$0.00	$9.63	$0.75	$0.00	$0.00	$59.60	$79.66
6th 1000 hrs	$42.63	$85.00	$7.50	$1.28	$0.43	$0.00	$10.23	$0.75	$0.00	$0.00	$62.82	$84.13
7th 1000 hrs	$45.14	$90.00	$7.50	$1.35	$0.45	$0.00	$10.83	$0.75	$0.00	$0.00	$66.02	$88.58

(*)Special Calculation Note :

Other is Health Reimburstment Account Operator "A" John Henry Rock Drill, D-6 (or equivalent) and above, Trackhoe Digger, (320 Track excavator), Cranes (greater then 25 tons and less than 45 tons). Operator "B" Cranes (greater than 6 tons and up to 25 tons), Backhoes, Road Tractor, Dozer up to D-5, Pressure Digger- wheeled or tracked, all Tension wire Stringing equipment. Operator "C" Trench, Backhoe, Riding type vibratory Compactor, Ground Rod Driver, Boom Truck (6 ton & below), Skid Steer Loaders, Material Handler.

Ratio :

(1) Journeyman Lineman to (1) Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Delaware, Fairfield, Fayette, Franklin, Gallia, Geauga, Greene, Guernsey, Hamilton, Harrison, Highland, Hocking, Holmes, Jackson, Jefferson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Pike, Portage, Preble, Richland, Ross, Scioto, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Vinton, Warren, Washington, Wayne

Special Jurisdictional Note :

Details :

Heli - Arc Welding will be paid $.30 above Journeyman rate. Additional compensation of 10% over the Journeyman Lineman and Journeyman Technician for performing work on structures outside of buildings such as water towers, smoke stacks, radio and television towers, more than 75' above the ground.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 71 Underground Residential Distribution

Type of Rate: Commercial

Change #: LCN02-2024ib

Craft: Electrical

Effective Date: 1/6/2025

Effective Date: 1/6/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
URD Electrican	$38.05		$7.50	$1.14	$0.38	$0.00	$9.13	$0.75	$0.00	$0.00	$56.95	$75.98
Equipment Operator A	$34.04		$7.50	$1.02	$0.34	$0.00	$8.17	$0.75	$0.00	$0.00	$51.82	$68.84
Equipment Operator B	$31.26		$7.50	$0.94	$0.31	$0.00	$7.50	$0.75	$0.00	$0.00	$48.26	$63.89
Directional Drill Locator	$34.04		$7.50	$1.02	$0.34	$0.00	$8.17	$0.75	$0.00	$0.00	$51.82	$68.84
Directional Drill Operator	$31.26		$7.50	$0.94	$0.31	$0.00	$7.50	$0.75	$0.00	$0.00	$48.26	$63.89
Groundman 0-12 months Exp	$24.70		$7.50	$0.74	$0.25	$0.00	$5.93	$0.75	$0.00	$0.00	$39.87	$52.22
Groundman 0-12 months Exp w/CDL	$27.24		$7.50	$0.82	$0.27	$0.00	$6.54	$0.75	$0.00	$0.00	$43.12	$56.74
Groundman 1 yr or more	$27.24		$7.50	$0.82	$0.27	$0.00	$6.54	$0.75	$0.00	$0.00	$43.12	$56.74
Groundman 1 yr or more w/CDL	$32.26		$7.50	$0.97	$0.32	$0.00	$7.74	$0.75	$0.00	$0.00	$49.54	$65.67
Apprentice	BHR	Percent										
1st 1000 hrs	$30.44	$80.00	$7.50	$0.91	$0.30	$0.00	$7.31	$0.75	$0.00	$0.00	$47.21	$62.43
2nd 1000 hrs	$32.34	$85.00	$7.50	$0.97	$0.32	$0.00	$7.76	$0.75	$0.00	$0.00	$49.64	$65.81
3rd 1000 hrs	$34.25	$90.00	$7.50	$1.03	$0.34	$0.00	$8.22	$0.75	$0.00	$0.00	$52.09	$69.21
4th 1000 hrs	$36.15	$95.00	$7.50	$1.08	$0.36	$0.00	$8.68	$0.75	$0.00	$0.00	$54.52	$72.59

(*)Special Calculation Note :

Other: Health Reimburstment Account

Ratio :

(1) Journeyman Lineman to (1) Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Delaware, Fairfield, Fayette, Franklin, Gallia, Geauga, Greene, Guernsey, Hamilton, Harrison, Highland, Hocking, Holmes, Jackson, Jefferson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Pike, Portage, Preble, Richland, Ross, Scioto, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Vinton, Warren, Washington, Wayne

Special Jurisdictional Note :

Details :

This work applies to projects designated for any outside Underground Residential Distribution construction work for electrical utilities, municipalities and rural electrification projects.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Electrical Local 71 Voice Data Video Outside

Type of Rate: Commercial

Change #: LCN02-2024ib

Craft: Electrical

Effective Date: 3/6/2024

Effective Date: 3/6/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrical Installer Technician I	$35.39		$7.25	$1.06	$0.00	$0.00	$1.77	$0.00	$0.00	$0.00	$45.47	$63.17
Installer Technician II	$33.37		$7.25	$1.00	$0.00	$0.00	$1.67	$0.00	$0.00	$0.00	$43.29	$59.98
Installer Repairman	$33.37		$7.25	$1.00	$0.00	$0.00	$1.67	$0.00	$0.00	$0.00	$43.29	$59.98
Equipment Operator II	$24.98		$7.25	$0.75	$0.00	$0.00	$1.25	$0.00	$0.00	$0.00	$34.23	$46.72
Cable Splicer	$35.39		$7.25	$1.06	$0.00	$0.00	$1.77	$0.00	$0.00	$0.00	$45.47	$63.17
Ground Driver W/CDL	$16.69		$7.25	$0.50	$0.00	$0.00	$0.83	$0.00	$0.00	$0.00	$25.27	$33.62
Groundman	$14.57		$7.25	$0.44	$0.00	$0.00	$0.73	$0.00	$0.00	$0.00	$22.99	$30.28
Apprentice	BHR	Percent										
Trainee F	$17.70	$50.01	$7.25	$0.53	$0.00	$0.89	$0.00	$0.00	$0.00	$0.00	$26.37	$35.22
Trainee E	$20.53	$58.00	$7.25	$0.62	$0.00	$1.03	$0.00	$0.00	$0.00	$0.00	$29.43	$39.69
Trainee D	$23.36	$66.00	$7.25	$0.70	$0.00	$1.17	$0.00	$0.00	$0.00	$0.00	$32.48	$44.16
Trainee C	$26.19	$74.00	$7.25	$0.79	$0.00	$1.31	$0.00	$0.00	$0.00	$0.00	$35.54	$48.63
Trainee B	$29.02	$82.00	$7.25	$0.87	$0.00	$1.45	$0.00	$0.00	$0.00	$0.00	$38.59	$53.10
Trainee A	$31.85	$90.00	$7.25	$0.96	$0.00	$1.59	$0.00	$0.00	$0.00	$0.00	$41.65	$57.58

(*)Special Calculation Note :

Ratio :

1Trainee to 1 Journeyman

Jurisdiction (* denotes special jurisdictional note) :

Adams, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Delaware, Fairfield, Fayette, Franklin, Gallia, Geauga, Greene, Guernsey, Hamilton, Harrison, Highland, Hocking, Holmes, Jackson, Jefferson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Pike, Portage, Preble, Richland, Ross, Scioto, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Vinton, Warren, Washington, Wayne

Special Jurisdictional Note :

Details :

Cable Splicer: Inspect and test lines or cables, analyze results, and evaluate transmission characteristics. Cover conductors with insulation or seal splices with moisture-proof covering. Install, splice, test, and repair cables using tools or mechanical equipment. This will include the splicing of fiber. Installer Technician I: Must know all aspects of telephone and cable work. This is to include aerial, underground, and manhole work. Must know how to climb and run bucket. Must have all the tools required to perform these tasks. Must be able to be responsible for the safety of the crew at all times. Must also have CDL license and have at least 5 years experience. Installer Repairman: Perform tasks of repairing, installing, and testing phone and CATV services. Installer Technician II: Have at least three years of telephone and CATV experience. Must have the knowledge of underground, aerial, and manhole work. Must be able to climb and operate bucket. Must have CDL. Must have all tools needed to perform these tasks. Equipment Operator II: Able to operate a digger derrick or bucket truck. Have at least 3 years of experience and must have a valid CDL license. Groundman W/CDL: Must have a valid CDL license and be able to perform tasks such as: climbing poles, pulling down guys, making up material, and getting appropriate tools for the job. Must have at least 5 year's experience. Groundman: Perform tasks such as: climbing poles, pulling down guys, making up material, and getting appropriate tools for the job. Experience 0-5 years.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Elevator Local 37

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2023ib	Elevator	1/1/2024	1/1/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Elevator Mechanic	$54.93		$16.17	$10.86	$0.75	$4.39	$10.10	$0.00	$0.00	$0.00	$97.20	$124.6
Helper	$38.45		$16.17	$10.86	$0.75	$3.07	$10.10	$0.00	$0.00	$0.00	$79.40	$98.63
Apprentice	BHR	Percent										
Probationary Apprentice	$27.47	$50.01	$0.00	$0.00	$0.00	$1.64	$0.00	$0.00	$0.00	$0.00	$29.11	$42.85
1st Year	$30.21	$55.00	$16.17	$10.86	$0.75	$1.81	$10.10	$0.00	$0.00	$0.00	$69.90	$85.01
2nd Year	$35.70	$65.00	$16.17	$10.86	$0.75	$2.14	$10.10	$0.00	$0.00	$0.00	$75.72	$93.58
3rd Year	$38.45	$70.00	$16.17	$10.86	$0.75	$2.30	$10.10	$0.00	$0.00	$0.00	$78.63	$97.86
4th Year	$43.94	$80.00	$16.17	$10.86	$0.75	$2.63	$10.10	$0.00	$0.00	$0.00	$84.45	$106.4
Assistant Mechanic	$43.94	$80.00	$16.17	$10.86	$0.75	$3.51	$10.10	$0.00	$0.00	$0.00	$85.33	$107.3

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice** 1 Journeyman to 1 Helper** 1 Journeyman to 1 Assistant Mechanic**

Jurisdiction (* denotes special jurisdictional note) :

Athens, Champaign, Clark, Delaware, Fairfield, Fayette, Franklin, Gallia, Guernsey, Hocking, Jackson, Knox, Lawrence, Licking, Logan, Madison, Marion, Meigs, Monroe*, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Pike, Ross, Union, Vinton

Special Jurisdictional Note :

Monroe County is shared by both Local 37 and Local 6.

Details :

**Art. 10 Par. 2 Apprentice Work Qualifications: Par 2- The total number of Helpers and Apprentices employed shall not exceed the number of Mechanics on any one job, except on jobs where two teams or more are working, one extra Helper or Apprentice may be employed for the first two teams and an extra Helper or Apprentice for each additional three teams. Further, the Company may use as many Helpers and Apprentices as best suits his convenience under the direction of a Mechanic in wrecking old plants and in handling and hoisting material, and on foundation work. When removing old and installing new cable on existing elevator installations, the Company may use two Helpers or Apprentices to one Mechanic.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Glazier Local 372

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN02-2024ib	Glazier	11/1/2024	11/1/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Glazier	$33.82		$6.20	$10.14	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$50.61	$67.52
Apprentice	BHR	Percent										
1st Year	$23.67	$70.00	$6.20	$2.84	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$33.16	$45.00
2nd Year	$25.37	$75.00	$6.20	$2.84	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$34.86	$47.54
3rd Year	$28.75	$85.00	$6.20	$6.55	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$41.95	$56.32
4th Year	$32.13	$95.00	$6.20	$6.55	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$45.33	$61.39

(*)Special Calculation Note :

No special calculations for this skilled craft wage rate are required at this time.

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Fayette*, Franklin, Hocking, Jackson, Knox, Licking, Madison, Marion, Morrow, Muskingum, Perry, Pickaway, Pike, Ross, Union, Vinton

Special Jurisdictional Note :

Fayette County - locations west of State Route 62 ONLY.

Details :

A premium of one dollar ($1.00) per hour above regular hourly rate of pay shall be paid for each hour worked by every employee from any mechanical lift or scaffold,either suspended or supported including the Hex type scaffolding.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Labor HevHwy 3

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN02-2025ib	Laborer	6/11/2025	6/11/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Laborer Group 1	$37.27		$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$53.37	$72.01
Group 2	$37.44		$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$53.54	$72.26
Group 3	$37.77		$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$53.87	$72.76
Group 4	$38.22		$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$54.32	$73.43
Watch Person	$32.00		$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$48.10	$64.10
Apprentice	BHR	Percent										
0-1000 hrs	$29.82	$80.00	$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$45.92	$60.82
1001-2000 hrs	$31.68	$85.00	$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$47.78	$63.62
2001-3000 hrs	$33.54	$90.00	$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$49.64	$66.41
3001-4000 hrs	$35.41	$95.00	$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$51.51	$69.21
More than 4000 hrs	$37.27	$100.00	$8.60	$4.45	$0.45	$0.00	$2.50	$0.00	$0.10	$0.00	$53.37	$72.01

(*)Special Calculation Note :

Watchmen have no Apprentices. Tunnel Laborer rate with air-pressurized add $1.00 to the above wage rate. Commercial Driver's License – Any Laborer required to utilize a valid Commercial Driver's License (CDL), are in compliance with necessary FMCSA regulations and approved by the Contractor to operate a Commercial Motor Vehicle (CMV), shall be paid one dollar ($1.00) per hour above the base rate for the entirety of their working shift.

Ratio :

1 Journeymen to 1 Apprentice 3 Journeymen to 1 Apprentice thereafter

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Darke, Defiance, Delaware, Fairfield, Fayette, Franklin, Fulton, Gallia, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Jackson, Jefferson, Knox, Lawrence, Licking, Logan, Madison, Marion, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Paulding, Perry, Pickaway, Pike, Preble, Putnam, Richland, Ross, Scioto, Seneca, Shelby, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne, Williams, Wyandot

Special Jurisdictional Note :

Hod Carriers and Common Laborers - Heavy, Highway, Sewer, Waterworks, Utility, Airport, Railroad, Industrial and Building Site, Sewer Plant, Waste Water Treatment Facilities Construction

Details :

Group 1 Laborer (Construction); Plant Laborer or Yardman, Right-of-way Laborer, Landscape Laborer, Highway Lighting Worker, Signalization Worker, (Swimming) Pool Construction Laborer, Utility Man, *Bridge Man, Handyman, Joint Setter, Flagperson, Carpenter Helper, Waterproofing Laborer, Slurry Seal, Seal Coating, Surface Treatment or Road Mix Laborer, Riprap Laborer & Grouter, Asphalt Laborer, Dump Man (batch trucks), Guardrail & Fence Installer, Mesh Handler & Placer, Concrete Curing Applicator, Scaffold Erector, Sign Installer, Hazardous Waste (level D), Diver Helper, Zone Person and Traffic Control. *Bridge Man will perfomr work as per the October 31, 1949, memorandum on concrete forms, byand between the United Brotherhood of Caprpenters and Joiners of Americ and the Laborers' International Union of North America, which states in; "the moving, cleaning, oiling and carrying to the next point of erection, and the stripping of forms which are not to be re-used, and forms on all flat arch work shall be done by memebers of the Laborers' International Union of North America." Group 2 Asphalt Raker, Screwman or Paver, Concrete Puddler, Kettle Man (pipeline), All Machine-Driven Tools (Gas, Electric, Air), Mason Tender, Brick Paver, Mortar Mixer, Skid Steer, Sheeting & Shoring Person, Surface Grinder Person, Screedperson, Water Blast, Hand Held Wand, Power Buggy or Power Wheelbarrow, Paint Striper, Plastic fusing Machine Operator, Rodding Machine Operator, Pug Mill Operator, Operator of All Vacuum Devices Wet or Dry, Handling of all Pumps 4 inches and under (gas, air or electric), Diver, Form Setter, Bottom Person, Welder Helper (pipeline), Concrete Saw Person, Cutting with Burning Torch, Pipe Layer, Hand Spiker (railroad), Underground Person (working in sewer and waterline, cleaning, repairing and reconditioning). Tunnel Laborer (without air),Caisson, Cofferdam (below 25 feet deep), Air Track and Wagon Drill, Sandblaster Nozzle Person, Hazardous Waste (level B), ***Lead Abatement, Hazardous Waste (level C) ***Includes the erecting of structures for the removal, including the encapsulation and containment of Lead abatement process. Group 3 Blast and Powder Person, Muckers will be defined as shovel men working directly with the miners, Wrencher (mechanical joints & utility pipeline), Yarner, Top Lander, Hazardous Waste (level A), Concrete Specialist, Curb Setter and Cutter, Grade Checker, Concrete Crew in Tunnels. Utility pipeline Tappers, Waterline, Caulker, Signal Person will receive the rate equal to the rate paid the Laborer classification for which the Laborer is signaling. Group 4 Miner,Welder, Gunite Nozzle Person A.) The Watchperson shall be responsible to patrol and maintain a safe traffic zone including but not limited to barrels, cones, signs, arrow boards, message boards etc. The responsibility of a watchperson is to see that the equipment, job and office trailer etc. are secure.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Labor Local 423

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Laborer	6/1/2025	6/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Laborer Group 1	$32.98		$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$47.53	$64.02
Group 2	$33.29		$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$47.84	$64.49
Group 3	$33.60		$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$48.15	$64.95
Group 4	$33.91		$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$48.46	$65.42
Apprentice	BHR	Percent										
0-1000 hrs	$23.09	$70.00	$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$37.64	$49.18
1001-2000 hrs	$26.38	$80.00	$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$40.93	$54.13
2001-3000 hrs	$29.68	$90.00	$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$44.23	$59.07
3001-4000 hrs	$31.33	$95.00	$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$45.88	$61.55
More than 4000 hrs	$32.98	$100.00	$8.60	$4.45	$0.40	$0.00	$1.00	$0.00	$0.10	$0.00	$47.53	$64.02

(*)Special Calculation Note :

Ratio :

1 Journeymen to 1 Apprentice 4 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Fairfield, Fayette, Franklin, Hocking, Licking, Madison, Pickaway, Union

Special Jurisdictional Note :

Details :

Group 1: General Laborers, Carpenter Tender, Cathodic Protection, Cleaning Debris, Cleaning of all Material, General Clean-up including Vacuum Cleaning, Scraping and Cleaning of Walls and Floors, Landscape, Installation and Removal of Fencing, Sod Layers, All Portable Heaters, Flagman, Loading and Unloading of all Trucks, Handling and conveying all Materials, Washing of all Windows, Conveyer Belt, All Water Pumps up to and including three (3) inch intake, Watchman, Water Boy and Tool Room Attendant. Group 1- Swimming Pools, Pool Decks, Surrounding Sidewalk and Parking Garages. Group 2: Skid Steer, Concrete Specialists, Brick Tender, Stone Mason Tender, Plaster Tender, Mortar Mixer and Operator, Cement Mason Tender, Construction Specialist, All Scaffold Builders (Swinging Scaffolds), Lagging, Bush Hammering,Jack Hammer Operator, Air or Electric Pneumatic Tool Operator, Power Driven Tools, Power Buggy Operators, Pouring and Placement of all concrete, Fork Lift Operators, Power Wheelbarrow Operators, Asphalt and Blacktop Rakers, Wrecker/Demolition, Sand Blasting and Chipping, Welders on Demolition, Grade Checkers, a person on a bucket pouring concrete, Gunite Nozzle man, Wagon and Churn Drill Operator, Concrete Saw Operator, Brush Feeders on pulverizers, Pipe Layers, Bottom Man, Laser Gun, Burners, Sand Blasting of concrete, Vibrator Man, Steward, Signal Man, Caisson, Caisson Bottom Man, Piledrivers, Asbestos and Lead Abatement Laborers. Hazardous Waste (Level B): Any work requiring the following protective equipment must be paid at Group 2 rate, A protective suit and an Air Purifying Respirator (APR) with the appropriate filter canisters. The ensemble is used when contaminants are reliably known not to be hazardous to the skin and not IDLH (Immediately Dangerous To Life or Health) and correct filter protection is available. This ensemble offers adequate protection for many jobs. Heat stress may be a problem due to inherent restrictions to breathing in an APR. Also, normal job related injury risk will be nearly as high as for Level C Equipment. Group 3 Hazardous (Level C:) Any work requiring the following protective equipment must be paid at Group 3 rate, A chemically resistant splash suit and a (SCBA) or Airline Respirator. This ensemble is required when the situation is very hazardous, such as oxygen deficient atmospheres, IDLH atmospheres, or confined space entries, but the risk of skin exposure is not as great as in Level D situations. Then Level C ensemble gives the second highest level of protection, but also puts physical stress on the worker; primarily heat stress, reduced vision,dexterity and mobility directly attributable to wearing of the protective equipment. Therefore, in addition to the hazardous material, the hazard of the normal job related injuries is greatly increased. Group 4 Hazardous Waste (Level D) requiring the following protective equipment must be paid at Group 4 rate, Protective equipment is required when the area has been known to contain extremely toxic contaminants or contaminants unknown but may be expected to be extremely toxic and /or Immediately Dangerous to Life and Health (IDLH). This ensemble includes fully encapsulated chemical suit (moon suit), Self Contained Breathing Apparatus (SCBA), or Airline Fed Respirator, and various types and numbers of boots and gloves, cool vests and voice activated radios are optional equipment sometimes worn. Level D ensembles provide the highest level of protection from contaminants but places the greatest physical and mental stress on the worker. The claustrophobic environment of the moon suit causes anxiety in most people, which greatly increases the already inherent heat stress problems. Also, this ensemble reduces vision, mobility, dexterity, and communication capacity, all of which increases the risk of normal job related injuries, ie., slips ,falls, caught between, etc . Hazardous Pay of $0.25 per hour shall be paid in addition to classifications shown above Swing Scaffolds (suspended by rope or pulley), and swing scaffolds for grain storage tank or grain elevators, when the work is performed at a height of fifty (50) feet or more above the foundations or grade level, whichever is higher. Caisson work and tunnel work (depth being 15 feet or deeper) Hazardous Waste Removal & Lead Abatement Workers: Exclusive or "Hot" area with toxic or hazardous materials, when one of the following personal protective equipment ensembles will be required for necessary protection against toxic contaminants. All of the ensembles increase the risks of certain types of worker-related injuries. When Laborers complement another craft receiving premium rate of pay Laborers will also receive premium pay for this "HOT" type of work.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Operating Engineers - Building Local 18 - Zone III

Type of Rate: Commercial

Change #: LCN01-2025ib

Craft: Operating Engineer

Effective Date: 5/1/2025

Effective Date: 5/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Operator Group A	$45.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$62.74	$85.66
Operator Group B	$45.72		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$62.62	$85.48
Operator Group C	$44.68		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$61.58	$83.92
Operator Group D	$43.50		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$60.40	$82.15
Operator Group E	$38.04		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$54.94	$73.96
Master Mechanic	$46.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.74	$87.16
Lift Director	$46.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.74	$87.16
Cranes & Mobile Concrete Pumps 150'-180'	$46.34		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.24	$86.41
Cranes & Mobile Concrete Pumps 180'-249'	$46.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.74	$87.16
Cranes & Mobile Concrete Pumps 249' and over	$47.09		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.99	$87.54
Apprentice	BHR	Percent										
1st Year	$22.92	$50.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$39.82	$51.28
2nd Year	$27.50	$60.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$44.40	$58.16
3rd Year	$32.09	$70.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$48.99	$65.03
4th Year	$36.67	$80.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$53.57	$71.91
Field Mechanic Trainee	$	$	$	$	$	$	$	$	$	$	$	$
1st Year	$27.50	$60.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$44.40	$58.16
2nd Year	$32.09	$70.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$48.99	$65.03
3rd Year	$36.67	$80.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$53.57	$71.91
4th Year	$41.26	$90.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$58.16	$78.78

(*)Special Calculation Note :

Other: Education & Safety Misc: National Training

Ratio :

For every (3) Operating Engineer Journeymen employed by the company there may be employed (1) Registered Apprentice or trainee Engineer through the referral when they are available. An apprenice, while employed as part of a crew per Article VIII, paragraph 77, will not be subject to the apprenticeship ratios in this collective bargaining agreement

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Coshocton, Crawford, Darke, Defiance, Delaware, Fairfield, Fayette, Franklin, Fulton, Gallia, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Jackson, Jefferson, Knox, Lawrence, Licking, Logan, Madison, Marion, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne, Williams, Wyandot

Special Jurisdictional Note :

Details :

Note: There will be a 10% increase for the apprentices on top of the percentages listed above provided they are operating mobile equipment. Group A- Barrier Moving Machines; Boiler Operators or Compressor Operators, when compressor or boiler is mounted on crane (Piggyback Operation); Boom Trucks (all types); Cableways Cherry Pickers; Combination - Concrete Mixers & Towers; All Concrete Pumps with Booms; Cranes (all types); Compact Cranes, track or rubber over 4,000 pounds capacity; Cranes self-erecting, stationary, track or truck (all configurations); Derricks (all types); Draglines; Dredges (dipper, clam or suction) 3-man crew; Elevating Graders or Euclid Loaders; Floating Equipment; Forklift (rough terrain with winch/hoist); Gradalls; Helicopter Operators, hoisting building materials; Helicopter Winch Operators, Hoisting building materials; Hoes (All types); Hoists (with two or more drums in use); Horizonal Directional Drill; Hydraulic Gantry (lift system); Laser Finishing Machines; Laser Screed and like equipment; Lift Slab or Panel Jack Operators; Locomotives (all types); Maintenance Operator/Technician(Mechanic Operator/Technician and/or Welder); Mixers, paving (multiple drum); Mobile Concrete Pumps, with booms; Panelboards, (all types on site); Pile Drivers; Power Shovels; Prentice Loader; Rail Tamper (with automatic lifting and aligning device); Rotary Drills (all), used on caissons for foundations and sub-structure; Side Booms; Slip Form Pavers; Straddle Carriers (Building Construction on site); Trench Machines (over 24” wide); Tug Boats. Group B - Articulating/end dumps (minus $4.00/hour from Group B rate); Asphalt Pavers; Bobcat-type and/or skid steer loader with hoe attachment greater than 7000 lbs.; Bulldozers; CMI type Equipment; Concrete Saw, Vermeer-type; Endloaders; Hydro Milling Machine; Kolman-type Loaders (Dirt Loading); Lead Greasemen; Mucking Machines; Pettibone-Rail Equipment; Power Graders; Power Scoops; Power Scrapers; Push Cats;, Rotomills (all), grinders and planers of all types. Group C - A-Frames; Air Compressors, Pressurizing Shafts or Tunnels; All Asphalt Rollers; Bobcat-type and/or Skid Steer Loader with or without attachments; Boilers (15 lbs. pressure and over); All Concrete Pumps (without booms with 5 inch system); Fork Lifts (except masonry); Highway Drills - all types (with integral power); Hoists (with one drum); House Elevators (except those automatic call button controlled), Buck Hoists, Transport Platforms, Construction Elevators; Hydro Vac/Excavator (when a second person is needed, the rate of pay will be “Class E”); Man Lifts; Material hoist/elevators; Mud Jacks; Pressure Grouting; Pump Operators (installing or operating Well Points or other types of Dewatering Systems); Pumps (4 inches and over discharge); Railroad Tie (Inserter/Remover); Rotovator (Lime-Soil Stabilizer); Submersible Pumps (4”and over discharge); Switch & Tie Tampers (without lifting and aligning device); Trench Machines (24” and under); Utility Operators. Group D - Backfillers and Tampers; Ballast Re-locator; Batch Plant Operators; Bar and Joint Installing Machines; Bull Floats; Burlap and Curing Machines; Clefplanes; Compressors, on building construction; Concrete Mixers, more than one bag capacity; Concrete Mixers, one bag capacity (side loaders); All Concrete Pumps (without boom with 4” or smaller system); Concrete Spreader; Conveyors, used for handling building materials; Crushers; Deckhands; Drum Fireman (in asphalt plants); Farm type tractors pulling attachments; Finishing Machines; Form Trenchers; Generators: Gunite Machines; Hydro-seeders; Pavement Breakers (hydraulic or cable); Post Drivers; Post Hole Diggers; Pressure Pumps (over 1/2”) discharge); Road Widening Trenchers; Rollers (except asphalt); Self-propelled sub-graders; Shotcrete Machines; Tire Repairmen; Tractors, pulling sheepsfoot post roller or grader; VAC/ALLS; Vibratory Compactors, with integral power; Welders. Group E – Allen Screed Paver (concrete); Boilers (less than 15 lbs. pressure); Cranes-Compact, track or rubber (under 4,000 pounds capacity); Directional Drill “Locator”; Fueling and greasing +$3.00; Inboard/outboard Motor Boat Launches; Light Plant Operators; Masonry Fork Lifts; Oilers/Helpers; Power Driven Heaters (oil fired); Power Scrubbers; Power Sweepers; Pumps (under 4 inch discharge); Signalperson, Submersible Pumps (under 4” discharge). Master Mechanics - Master Mechanic Cranes 150’ – 180’ - Boom & Jib 150 - 180 feet Cranes 180’ – 249’ - Boom & Jib 180 - 249 feet Cranes 250’ and over - Boom & Jib 250 feet or over

Prevailing Wage Rate
Skilled Crafts

Name of Union: Operating Engineers - HevHwy Zone II

Type of Rate: Commercial

Change #: LCN01-2025ib

Craft: Operating Engineer

Effective Date: 5/1/2025

Effective Date: 5/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Operator Class A	$45.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$62.74	$85.66
Operator Class B	$45.72		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$62.62	$85.48
Operator Class C	$44.68		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$61.58	$83.92
Operator Class D	$43.50		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$60.40	$82.15
Operator Class E	$38.04		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$54.94	$73.96
Master Mechanic	$46.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.74	$87.16
Lift Director	$46.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.74	$87.16
Crane and Mobile Concrete Pump 150' - 179'	$46.34		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.24	$86.41
Crane and Mobile Concrete Pump 180' - 249'	$46.84		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.74	$87.16
Crane and Mobile Concrete Pump 250' and Ove	$47.09		$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$63.99	$87.54
Apprentice	BHR	Percent										
1st Year	$22.92	$50.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$39.82	$51.28
2nd Year	$27.50	$60.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$44.40	$58.16
3rd Year	$32.09	$70.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$48.99	$65.03
4th Year	$36.67	$80.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$53.57	$71.91
Field Mech Trainee	$	$	$	$	$	$	$	$	$	$	$	$
1st year	$27.50	$60.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$44.40	$58.16
2nd year	$32.09	$70.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$48.99	$65.03
3rd year	$36.67	$80.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$53.57	$71.91
4th year	$41.26	$90.00	$9.51	$6.25	$0.95	$0.00	$0.00	$0.09	$0.00	$0.10	$58.16	$78.78

(*)Special Calculation Note :

Other: Education & Safety Fund Misc: National Training

Ratio :

For every (3) Operating Engineer Journeymen employed by the company, there may be employed (1) Registered Apprentice or Trainee Engineer through the referral when they are available. An Apprentice, while employed as part of a crew per Article VIII, paragraph 68 will not be subject to the apprenticeship ratios in this collective bargaining agreement

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Coshocton, Crawford, Darke, Defiance, Delaware, Fairfield, Fayette, Franklin, Fulton, Gallia, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lawrence, Licking, Logan, Lucas, Madison, Marion, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne, Williams, Wood, Wyandot

Special Jurisdictional Note :

Details :

**Apprentices wilt receive a 10% increase on top of the percentages listed above provided they are operating mobile equipment. Class A - Air Compressors on Steel Erection; Asphalt Plant Engineers (Cleveland District Only); Barrier Moving Machine; Boiler Operators, Compressor Operators, or Generators, when mounted on a rig; Boom Trucks (all types); Cableways; Cherry Pickers; Combination- Concrete Mixers & Towers; Concrete Plants (over 4 yd capacity); Concrete Pumps; Cranes (all types); Compact Cranes track or rubber over 4,000 pounds capacity; Cranes self-erecting stationary, track or truck; Derricks (all types); Draglines; Dredges dipper, clam or suction; Elevating Graders or Euclid Loaders; Floating Equipment (all types); Gradalls; Helicopter Crew (Operator- hoist or winch); Hoes (all types); Hoisting Engines; Hoisting Engines, on shaft or tunnel work; Hydraulic Gantry (lifting system); Industrial-type Tractors; Jet Engine Dryer (D8 or D9) diesel Tractors; Locomotives (standard gauge); Maintenance Operators/Technicians (class A); Mixers, paving (single or double drum); Mucking Machines; Multiple Scrapers; Piledriving Machines (all types); Power Shovels, Prentice Loader; Quad 9 (double pusher); Rail Tamper (with automatic lifting and aligning device); Refrigerating Machines (freezer operation); Rotary Drills, on caisson work; Rough Terrain Fork Lift with winch/hoist; Side Booms; Slip Form Pavers; Survey Crew Party Chiefs; Tower Derricks; Tree Shredders; Trench Machines (over 24" wide); Truck Mounted Concrete Pumps; Tug Boats; Tunnel Machines and /or Mining Machines; Wheel Excavators. Class B - Asphalt Pavers; Automatic Subgrade Machines, self-propelled (CMI-type); Bobcat-type and /or Skid Steer Loader with hoe attachment greater than 7000 lbs.; Boring Machine Operators (more than 48 inches); Bulldozers; Concrete Saws, Vermeer type; Endloaders; Horizontal Directional Drill (50,000 ft. lbs. thrust and over); Hydro Milling Machine; Kolman-type Loaders (production type-dirt); Lead Greasemen; Lighting and Traffic Signal Installation Equipment includes all groups or classifications; Maintenance Operators/Technicians, Class B; Material Transfer Equipment (shuttle buggy) Asphalt; Pettibone-Rail Equipment; Power Graders; Power Scrapers; Push Cats; Rotomills (all), Grinders and Planners of all types, Groovers (excluding walk-behinds); Trench Machines (24 inch wide and under). Class C - A-Frames; Air Compressors, on tunnel work (low Pressure); Articulating/straight bed end dumps if assigned (minus $4.00 per hour); Asphalt Plant Engineers (Portage and Summit Counties only); Bobcat-type and/or skid steer loader with or without attachments; Drones; Highway Drills (all types); HydroVac/Excavator (when a second person is needed, the rate of pay will be "Class E"); Locomotives (narrow gauge); Material Hoist/Elevators; Mixers, concrete (more than one bag capacity); Mixers, one bag capacity (side loader); Power Boilers (over 15 lbs. pressure); Pump Operators (installing or operating well Points); Pumps (4 inch and over discharge); Railroad Tie Inserter/Remover; Rollers, Asphalt; Rotovator (lime-soil Stabilizer); Switch & Tie Tampers (without lifting and aligning device); Utilities Operators, (small equipment); Welding Machines and Generators. Class D – Backfillers and Tampers; Ballast Re-locator; Bar and Joint Installing Machines; Batch Plant Operators; Boring Machine Operators (48 inch or less); Bull Floats; Burlap and Curing Machines; Concrete Plants (capacity 4 yds. and under); Concrete Saws (multiple); Conveyors (highway); Crushers; Deckhands; Farm type tractors, with attachments (highway); Finishing Machines; Firemen, Floating Equipment (all types); Fork Lifts (highway), except masonry; Form Trenchers; Hydro Hammers; Hydro Seeders; Pavement Breakers (hydraulic or cable); Plant Mixers; Post Drivers; Post Hole Diggers; Power Brush Burners; Power Form Handling Equipment; Road Widening Trenchers; Rollers (brick, grade, macadam); Self-Propelled Power Spreaders; Self-Propelled Sub-Graders; Steam Firemen; Survey Instrument men; Tractors, pulling sheepsfoot rollers or graders; Vibratory Compactors, with integral power. Class E - Compressors (portable, Sewer, Heavy and Highway); Cranes-Compact, track or rubber under 4,000 pound capacity; Drum Firemen (asphalt plant); Fueling and greasing (Primary Operator with Specialized CDL Endorsement Add $3.00/hr); Generators; Inboard-Outboard Motor Boat Launches; Masonry Fork Lifts; Oil Heaters (asphalt plant); Oilers/Helpers; Power Driven Heaters (oil fired); Power Scrubbers; Power Sweepers; Pumps (under 4 inch discharge); Signalperson; Survey Rodmen or Chairmen; Tire Repairmen; VAC/ALLS. Master Mechanic - Master Mechanic Cranes and Mobile Concrete Pumps 150' -179' - Boom & Jib 150 - 179 feet Cranes and Mobile Concrete Pumps 180' - 249' - Boom & Jib 180 - 249 feet Cranes and Mobile Concrete Pumps 250' and over - Boom & Jib 250 feet or over

Prevailing Wage Rate
Skilled Crafts

Name of Union: Painter Local 1275

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2024ib	Painter	5/8/2024	5/8/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Painter Brush Roll	$29.20		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$44.46	$59.06
Wall Washer	$29.20		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$44.46	$59.06
Spray	$29.70		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$44.96	$59.81
Structural Steel Swing Stage	$29.50		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$44.76	$59.51
Sandblast, Steam Clean, Water Blasting (3500 PSI and Over) and Hazardous	$29.90		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$45.16	$60.11
Vinyl Hanging	$29.70		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$44.96	$59.81
Apprentice	BHR	Percent										
0-1500 hrs	$23.36	$80.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$31.08	$42.76
1501-3000 hrs	$24.82	$85.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$32.54	$44.95
3001-4500 hrs	$26.28	$90.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$34.00	$47.14
4501-6000 hrs	$27.74	$95.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$35.46	$49.33

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Fayette, Franklin, Knox, Licking, Madison, Muskingum, Perry, Pickaway, Ross, Union

Special Jurisdictional Note :

Details :

Heavy Highway Class 1 are qualified painters,blasters,riggers. Class 2 Equipment Tenders /or containment Builders are hired to tend employers equipment also engage in the building & moving of containment systems. Class 3 support personnel will perform Quality control duties,clean abrasive blast materials, load and unload trucks, handle all materials, man safety boats, & handle traffic control. All Tanks 50,000 gallon capacity or more will be at the tank stated rate.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Painter Local 1275 Drywall

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2024ib	Painter	5/8/2024	5/8/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Painter Drywall Finisher	$30.85		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$46.11	$61.54
Drywall Taper	$30.85		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$46.11	$61.54
Drywall Sanders	$30.20		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$45.46	$60.56
Drywall, Use of Mechanical or Pneumatic Tools	$31.60		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$46.86	$62.66
Apprentice	BHR	Percent										
1st 0-1500 hrs	$24.68	$80.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$32.40	$44.74
2nd 1501-3000 hrs	$26.22	$85.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$33.94	$47.05
3rd 3001-4500 hrs	$27.77	$90.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$35.49	$49.37
4th 4501-6000 hrs	$29.31	$95.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$37.03	$51.68

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Fayette, Franklin, Knox, Licking, Madison, Muskingum, Perry, Pickaway, Ross, Union

Special Jurisdictional Note :

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Painter Local 1275 HevHwy

Type of Rate: Commercial

Change #: LCN01-2024ib

Craft: Painter

Effective Date: 5/8/2024

Effective Date: 5/8/2024

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Painter Bridge Class 1	$39.26	$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$54.52	$74.15
Painter Bridges Class 2 Rigger, Containment Builder, Spot Blaster	$36.26	$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$51.52	$69.65
Painter Bridges Class 3 Equipment Operator/ Field Mechanic, Grit Reclamation, Paint Mix, Traffic Control, Boat Person, Driver (0-5 Years Exp.)	$29.26	$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$44.52	$59.15
Painter Bridges Class 3 Equipment Operator/ Field Mechanic, Grit Reclamation, Paint Mix, Trafiic Control, Boat Person, Driver (plus 5 Years Exp.)	$32.26	$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$47.52	$63.65
Painter Bridges Class 4 Concrete Sealing, Concrete Blasting Power Washing	$28.26	$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$43.52	$57.65

Painter Bridges Class 5 Quality Control, Quality Assurance, Traffic Safety Competent Person	$32.26		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$47.52	$63.65
Apprentice	BHR	Percent										
1st 0-1500 hrs	$31.41	$80.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$39.13	$54.83
2nd 1501-3000 hrs	$33.37	$85.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$41.09	$57.78
3rd 3001-4500 hrs	$35.33	$90.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$43.05	$60.72
4th 4501-6000 hrs	$37.30	$95.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$45.02	$63.67

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Fayette, Franklin, Knox, Licking, Madison, Muskingum, Perry, Pickaway, Ross, Union

Special Jurisdictional Note :

Details :

Heavy Highway Class 1 are qualified painters,blasters,riggers. Class 2 Equipment Tenders /or containment Builders are hired to tend employers equipment also engage in the building & moving of containment systems. Class 3 support personnel will perform Quality control duties,clean abrasive blast materials, load and unload trucks, handle all materials, man safety boats, & handle traffic control.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Painter Local 1275 Industrial

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2023ib	Painter	5/8/2024	5/8/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Painter Brush Roll	$30.65		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$45.91	$61.24
Power Tool Cleaningr	$30.65		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$45.91	$61.24
Spray Painting	$31.15		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$46.41	$61.99
Sand Blast, Steam Clean & Pressure Washing Above 3500 PSI	$31.35		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$46.61	$62.29
Stacks and towers	$33.46		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$48.72	$65.45
Tanks - All Tanks 50,000 gallon capacity or more	$33.46		$6.50	$8.31	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$48.72	$65.45
Apprentice	BHR	Percent										
0-1500 hrs	$24.52	$80.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$32.24	$44.50
1501-3000 hrs	$26.05	$85.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$33.77	$46.80
3001-4500 hrs	$27.59	$90.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$35.31	$49.10
4501-6000 hrs	$29.12	$95.00	$6.50	$0.77	$0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$36.84	$51.40

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Fayette, Franklin, Knox, Licking, Madison, Muskingum, Perry, Pickaway, Ross, Union

Special Jurisdictional Note :

Details :

Definition of Industrial Classification: Industrial Facilities to be included in the Industrial Classification shall include; Water Treatment, Waste Water Treatment, Natural Gas and related facilities, refineries, transmission pipe lines, electrical transmission towers and or switching /sub stations and Power Plants. Exclusions from the industrial classification are Power Plants that generate power to a single customer; such as an emergency power supplier or a Hospital, Information Technology Facility, Sporting/Event or Arena/Stadium type facility. This exclusion would also be given to any commercial office space located within the facilities property. The excluded spaces shall be done under the Commercial Wage rates.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Painter Local 639 Sign and Display

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Painter	6/18/2025	6/18/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Top Mechanic Class A	$27.53		$4.50	$0.00	$0.00	$0.00	$0.00	$1.45	$0.00	$0.00	$33.48	$47.25
Top Mechanic Class B	$27.53		$4.50	$0.75	$0.00	$0.53	$0.00	$1.45	$0.00	$0.00	$34.76	$48.53
Top Helper Class A	$22.33		$4.50	$0.00	$0.00	$0.00	$0.00	$1.20	$0.00	$0.00	$28.03	$39.20
Top Helper Class B	$22.33		$4.50	$0.75	$0.00	$0.43	$0.00	$1.20	$0.00	$0.00	$29.21	$40.38
Helper Class A	$17.19		$4.50	$0.00	$0.00	$0.00	$0.00	$0.90	$0.00	$0.00	$22.59	$31.19
Helper Class B	$17.19		$4.50	$0.75	$0.00	$0.30	$0.00	$0.90	$0.00	$0.00	$23.64	$32.24
New Hire (90 Days)	$15.75		$4.50	$0.00	$0.00	$0.00	$0.00	$0.55	$0.00	$0.00	$20.80	$28.68
Apprentice	BHR	Percent										

(*)Special Calculation Note :

Other: Sick, Personal & Holiday Pay Swing Stage Rate: Employees shall receive a differential of $1.50 per hour for all hours worked on scaffolds four sections or higher, including any boom lifts and swing stage scaffolds. In addition, the rigging and derigging of hanging/suspended swing stage systems and rappelling/bolson chair work of a single employee will qualify for $1.50 differential, will be paid to a single lead Top Mechanic or single lead Top Helper on any given swing stage job, even when it includes multiple running rigs on a single jobsite.

Ratio :

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Gallia, Geauga, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lake, Lawrence, Licking, Logan, Lorain, Lucas, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Portage, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne, Williams, Wood, Wyandot

Special Jurisdictional Note :

Details :

The work performed by employees covered by this rate shall include cleaning and refinishing of architectural metals using chemicals, solvents, coatings and hand-applied lacquer thinner, removing scratches from mirror finished metals, burnishing of bronze, statuary finishes on exterior and interior surfaces during the course of the restoration and maintenance of architectural metals, and other specialty metal finishing work, and the use of all tools required to perform such work, including but not limited to polishes, spray equipment and scaffolding. Class A: Less Than 1 Year of Service Class B: More Than 1 Year of Service Top Mechanic: Top Mechanic shall be responsible for ensuring the highest quality of workmanship by Helpers, and be highly competent and knowledgeable in the following areas: coatings, both solvent and waterborne, spraying ability, stainless steel, aluminum and bronze finishing, scaffolding and swing stage work. The Top Mechanic shall also be responsible for providing necessary training of employees in lower classifications and for directing all employees in his/her crew to perform their responsibilities in a productive and efficient manner. Top Helper: For existing Top Helpers at the time of this Agreement shall, in addition to performing the responsibilities of a Helper, be responsible and accountable for the setup, breakdown, safety and quality of the Company's product. Helper: A Helper shall be responsible for performing tasks in refinishing, compliance with safety procedures, setting up and breaking down job sites, setting up and breaking down scaffolding and swing stages, preparing surfaces for refinishing, including but not limited to masking and stripping, cleaning, oxidizing, polishing and scratch removal on various finishes.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Painter Local 639 Zone 2 Sign

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Painter	5/28/2025	5/28/2025

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Painter Sign Journeyman Tech/Team Leader Class A	$26.56	$3.36	$0.21	$0.00	$0.00	$0.00	$0.72	$0.00	$0.00	$30.85	$44.13
Painter Sign Journeyman Tech/Team Leader Class B	$26.56	$3.36	$0.21	$0.00	$0.51	$0.00	$0.72	$0.00	$0.00	$31.36	$44.64
Painter Sign Journeyman Tech/Team Leader Class C	$26.56	$3.36	$0.21	$0.00	$1.02	$0.00	$0.72	$0.00	$0.00	$31.87	$45.15
Painter Sign Journeyman Tech/Team Leader Class D	$26.56	$3.36	$0.21	$0.00	$1.53	$0.00	$0.72	$0.00	$0.00	$32.38	$45.66
Sign Journeyman Class A	$26.27	$3.36	$0.21	$0.00	$0.00	$0.00	$0.71	$0.00	$0.00	$30.55	$43.69
Sign Journeyman Class B	$26.27	$3.36	$0.21	$0.00	$0.51	$0.00	$0.71	$0.00	$0.00	$31.06	$44.20
Sign Journeyman Class C	$26.27	$3.36	$0.21	$0.00	$1.01	$0.00	$0.71	$0.00	$0.00	$31.56	$44.70
Sign Journeyman Class D	$26.27	$3.36	$0.21	$0.00	$1.52	$0.00	$0.71	$0.00	$0.00	$32.07	$45.21
Tech Sign Fabrication/ Erector Class A	$20.67	$3.36	$0.21	$0.00	$0.00	$0.00	$0.56	$0.00	$0.00	$24.80	$35.14
Tech Sign Fabrication/ Erector Class B	$20.67	$3.36	$0.21	$0.00	$0.40	$0.00	$0.56	$0.00	$0.00	$25.20	$35.54

Tech Sign Fabrication/ Erector Class C	$20.67		$3.36	$0.21	$0.00	$0.80	$0.00	$0.56	$0.00	$0.00	$25.60	$35.94
Tech Sign Fabrication/ Erector Class D	$20.67		$3.36	$0.21	$0.00	$1.19	$0.00	$0.56	$0.00	$0.00	$25.99	$36.33
Apprentice	BHR	Percent										

(*)Special Calculation Note :

Other is for paid holidays.

Ratio :

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Auglaize, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Greene, Hamilton, Hancock, Hardin, Henry, Highland, Holmes, Huron, Jackson, Knox, Licking, Logan, Lorain, Lucas, Madison, Mahoning, Marion, Mercer, Miami, Montgomery, Morrow, Muskingum, Ottawa, Paulding, Perry, Pickaway, Pike, Preble, Putnam, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Trumbull, Tuscarawas, Union, Van Wert, Warren, Wayne, Williams, Wood, Wyandot

Special Jurisdictional Note :

Details :

Class A: less that 1 year. Class B: 1-3 years. Class C; 3-10 years. Class D: More than 10 years.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Plasterer Local 132 (Columbus)

Type of Rate: Commercial

Change #: LCN01-2025ib

Craft: Plasterer

Effective Date: 6/1/2025

Effective Date: 6/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Plasterer	$31.68		$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$47.14	$62.98
Fireproofing Gunner	$32.68		$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$48.14	$64.48
Apprentice	BHR	Percent										
1st 800 hrs	$22.18	$70.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$37.64	$48.72
2nd 800 hrs	$23.44	$74.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$38.90	$50.62
3rd 800 hrs	$24.71	$78.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$40.17	$52.53
4th 800 hrs	$25.98	$82.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$41.44	$54.43
5th 800 hrs	$27.24	$86.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$42.70	$56.33
6th 800 hrs	$28.51	$90.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$43.97	$58.23
7th 800 hrs	$29.78	$94.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$45.24	$60.13
8th 800 hrs	$31.05	$98.00	$8.20	$4.70	$0.50	$0.00	$2.00	$0.06	$0.00	$0.00	$46.51	$62.03

(*)Special Calculation Note :

*Other is International Training Fund

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Ashland, Coshocton, Crawford, Delaware, Fairfield, Fayette, Franklin, Guernsey, Hocking, Knox, Licking, Madison, Marion, Morrow, Muskingum, Perry, Pickaway, Richland, Ross, Union, Vinton, Wyandot

Special Jurisdictional Note :

Details :

Fireproofing Gunner: If any mechanical means is used in the gauging of lime for any finish coat, the mixing shall be gauged by a member of the crew who is to apply the respective gauging. This clause applies on jobs where cementitious and fibrous type fireproofing is the material being applied. There shall be an equal number of plasterers to nozzles used. Working on swing stage, slip scaffold or window jack scaffold shall receive the following rates: $0 above the regular rate for heights up to forty-nine (49) feet above grade level $0.75 above the regular rate for heights over fifty (50) feet above grade level

Prevailing Wage Rate
Skilled Crafts

Name of Union: Plumber Pipefitter Local 189

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2024ib	Plumber Pipefitter	8/21/2024	8/21/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Plumber Pipefitter	$49.00		$10.39	$7.49	$1.45	$0.00	$8.26	$0.00	$0.00	$0.00	$76.59	$101.0
Heating Piping Refrigeration, Temperature Control, Air Conditioning Welder	$49.00		$10.39	$7.49	$1.45	$0.00	$8.26	$0.00	$0.00	$0.00	$76.59	$101.09
Apprentice	BHR	Percent										
1st Year	$22.05	$45.00	$5.00	$0.00	$1.45	$0.00	$0.00	$0.10	$0.00	$0.00	$28.60	$39.63
2nd Year	$24.50	$50.00	$10.39	$5.60	$1.45	$0.00	$0.00	$0.10	$0.00	$0.00	$42.04	$54.29
3rd Year	$26.95	$55.00	$10.39	$5.60	$1.45	$0.00	$0.00	$0.10	$0.00	$0.00	$44.49	$57.97
4th Year	$31.85	$65.00	$10.39	$5.60	$1.45	$0.00	$6.26	$0.10	$0.00	$0.00	$55.65	$71.58
5th Year	$39.20	$80.00	$10.39	$5.60	$1.45	$0.00	$8.26	$0.10	$0.00	$0.00	$65.00	$84.60

(*)Special Calculation Note :

*Other is International Training

Ratio :

Employees-------Journeyman to Apprentice per Job 1) 1-0 2) 1-1 3) 2-1 4) 2-2 5) 3-2 6) 4-2 7) 4-3 8) 5-3 9) 6-3 10) 6-4 11) 7-4 12) 8-4 13) 8-5 14) 9-5 15) 10-5 16) 10-6 17) 11-6 18) 12-6 19) 12-7 20) 13-7 21) 14-7 22) 14-8 23) 15-8 24) 16-8 25) 16-9 Heating Piping refrigeration,Temperature Control,Air Conditioning Ratio (1) Additional Apprentice to (3) Journeymen thereafter Employees Journeyman to Apprentice per Job 1) Employee 1-0 2) Employees 1-1 3) Employees 2-1 4) Employees 2-2 5)Employees 3-2 6) Employees 4-2 7) Employees 5-2 8) Employees 5-3 9) Employees 6-3 10)Employees 7-3 11)Employees 8-3 12)Employees 8-4 13)Employees 9-4 14)Employees 10-4 15)Employees 11-4 16) Employees 11-5 17) Employees 12-5 18) Employees 13-5 19) Employees 14-5 20)Employees 14-6 21)Employees 15-6 22)Employees 17-5 23)Employees 18-5 24)Employees 18-6 25)Employees 19-6 26)Employees 20-6 28)Employees 22-6 29)Employees 22-7 30) Employees 23-7 31)Employees 23-7 32) Employees 25-7 33)Employees 26-7 34)Employees 26-8

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Franklin, Hocking, Licking, Madison, Marion, Perry, Pickaway, Ross, Union

Special Jurisdictional Note :

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Roofer Local 86

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Roofer	9/3/2025	9/3/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Roofer	$38.33		$8.20	$7.40	$0.88	$0.00	$0.30	$0.09	$0.00	$0.00	$55.20	$74.36
Apprentice	BHR	Percent										
1st Year	$24.91	$65.00	$0.00	$0.00	$0.88	$0.00	$0.25	$0.09	$0.00	$0.00	$26.13	$38.59
2nd Year	$27.60	$72.00	$8.20	$1.85	$0.88	$0.00	$0.25	$0.09	$0.00	$0.00	$38.87	$52.67
3rd Year	$30.66	$80.00	$8.20	$3.33	$0.88	$0.00	$0.25	$0.09	$0.00	$0.00	$43.41	$58.74
4th Year	$33.73	$88.00	$8.20	$4.81	$0.88	$0.00	$0.25	$0.09	$0.00	$0.00	$47.96	$64.83

(*)Special Calculation Note :

Other: Education & Research Fund

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Champaign, Delaware, Fairfield, Fayette, Franklin, Hardin, Hocking, Knox, Licking, Logan, Madison, Marion, Morrow, Perry, Pickaway, Pike, Ross, Union, Wyandot

Special Jurisdictional Note :

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Sheet Metal Local 24 (Columbus)

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCN01-2025ib	Sheet Metal Worker	6/11/2025	6/11/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Sheet Metal Worker	$41.10		$10.23	$12.56	$1.26	$0.00	$4.12	$0.00	$0.00	$0.00	$69.27	$89.82
Apprentice	BHR	Percent										
1st Year	$23.43	$57.00	$8.42	$2.19	$1.05	$0.00	$0.00	$0.00	$0.00	$0.00	$35.09	$46.80
2nd Year	$26.72	$65.00	$9.61	$8.17	$1.05	$0.00	$0.00	$0.00	$0.00	$0.00	$45.55	$58.90
3rd Year	$30.83	$75.00	$9.84	$9.42	$1.26	$0.00	$3.09	$0.00	$0.00	$0.00	$54.44	$69.85
4th Year	$34.94	$85.00	$9.99	$10.67	$1.26	$0.00	$3.50	$0.00	$0.00	$0.00	$60.36	$77.82

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice 2 Journeymen to 2 Apprentices 3 Journeymen to 3 Apprentices 4 Journeymen to 4 Apprentices 5-7 Journeymen to 5 Apprentices 8-10 Journeymen to 6 Apprentices 11-13 Journeyman to 7 Apprentices 14-16 Journeyman to 8 Apprentices 17-19 Journeymen to 9 Apprentices 20-22 Journeymen to 10 Apprentices 23-25 Journeymen to 11 Apprentices 26-28 Journeymen to 12 Apprentices 29-31 Journeymen to 13 Apprentices 32-34 Journeymen to 14 Apprentices 35-37 Journeymen to 15 Apprentices 38-40 Journeymen to 16 Apprentices and so on

Jurisdiction (* denotes special jurisdictional note) :

Adams, Athens, Delaware, Fairfield, Fayette, Franklin, Gallia, Guernsey, Hocking, Jackson, Knox, Lawrence, Licking, Madison, Marion, Meigs, Morgan, Morrow, Muskingum, Noble, Perry, Pickaway, Pike, Ross, Scioto, Union, Vinton

Special Jurisdictional Note :

Details :

Prevailing Wage Rate
Skilled Crafts

Name of Union: Sprinkler Fitter Local 669

Type of Rate: Commercial

Change #:	**Craft:**	**Effective Date:**	**Effective Date:**
LCR01-2025ib	Sprinkler Fitter	8/6/2025	8/6/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Sprinkler Fitter	$48.28		$12.40	$7.40	$0.54	$0.00	$7.74	$0.00	$0.00	$0.00	$76.36	$100.5
Apprentice	BHR	Percent										
CLASS 1	$24.14	$50.00	$9.03	$0.00	$0.54	$0.00	$0.00	$0.00	$0.00	$0.00	$33.71	$45.78
CLASS 2	$27.04	$56.00	$9.03	$0.00	$0.54	$0.00	$0.00	$0.00	$0.00	$0.00	$36.61	$50.13
CLASS 3	$29.45	$61.00	$12.40	$7.40	$0.54	$0.00	$1.15	$0.00	$0.00	$0.00	$50.94	$65.66
CLASS 4	$31.38	$65.00	$12.40	$7.40	$0.54	$0.00	$1.15	$0.00	$0.00	$0.00	$52.87	$68.56
CLASS 5	$33.31	$69.00	$12.40	$7.40	$0.54	$0.00	$1.40	$0.00	$0.00	$0.00	$55.05	$71.70
CLASS 6	$36.21	$75.00	$12.40	$7.40	$0.54	$0.00	$1.40	$0.00	$0.00	$0.00	$57.95	$76.05
CLASS 7	$38.14	$79.00	$12.40	$7.40	$0.54	$0.00	$1.40	$0.00	$0.00	$0.00	$59.88	$78.95
CLASS 8	$40.56	$84.00	$12.40	$7.40	$0.54	$0.00	$1.40	$0.00	$0.00	$0.00	$62.30	$82.58
CLASS 9	$42.97	$89.00	$12.40	$7.40	$0.54	$0.00	$1.40	$0.00	$0.00	$0.00	$64.71	$86.19
CLASS 10	$44.90	$93.00	$12.40	$7.40	$0.54	$0.00	$1.40	$0.00	$0.00	$0.00	$66.64	$89.09

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Gallia, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lawrence, Licking, Logan, Lucas, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Portage, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne, Williams, Wood, Wyandot

Special Jurisdictional Note :

Details :

Sprinkler Fitter work shall consist of the installation, dismantling, maintenance, repairs, adjustments, and corrections of all fire protection and fire control systems including the unloading, handling by hand, power equipment and installation of all piping or tubing, appurtenances and equipment pertaining thereto, including both overhead and underground water mains, fire hydrants and hydrant mains, standpipes and hose connections to sprinkler systems used in connection with sprinkler and alarm systems. Also all tanks and pumps connected thereto, also included shall be CO-2 and Cardox Systems, Dry Chemical Systems, Foam Systems and all other fire protection systems.

Prevailing Wage Rate
Skilled Crafts

Name of Union: Truck Driver Locals 20,40,92,100,175,284,348,377,637,697,908,957 - Bldg & HevHwy Class 1

Type of Rate: Commercial

Change #:
LCN01-2025ib

Craft:
Truck Driver

Effective Date:
5/28/2025

Effective Date:
5/28/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Truck Driver CLASS 1	$34.26		$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$53.51	$70.64
Apprentice	BHR	Percent										
First 6 months	$27.41	$80.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$46.66	$60.36
7-12 months	$29.12	$85.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$48.37	$62.93
13-18 months	$30.83	$90.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$50.08	$65.50
19-24 months	$32.55	$95.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$51.80	$68.07
25-30 months	$34.26	$100.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$53.51	$70.64

(*)Special Calculation Note :

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Gallia, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lawrence, Licking, Logan, Lorain, Lucas, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Portage, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne, Williams, Wood, Wyandot

Special Jurisdictional Note :

Details :

CLASS 1: Drivers on trucks, including but not limited to: 4-wheel service trucks; 4-wheel dump trucks; batch trucks; drivers on tandems; truck sweepers (not to include power sweepers and scrubbers) Drivers on tractor – trailer combinations including but not limited to the following: Semi-tractor trucks; pole trailers; ready-mix trucks; fuel trucks; all trucks five (5) axle and over; drivers on belly dumps; truck mechanics (when needed).

Prevailing Wage Rate
Skilled Crafts

Name of Union: Truck Driver Locals 20,40,92,100,175,284,348,377,637,697,908,957 - Bldg & HevHwy Class 2

Type of Rate: Commercial

Change #:
LCN01-2025ib

Craft:
Truck Driver

Effective Date:
5/28/2025

Effective Date:
5/28/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Truck Driver CLASS 2	$35.26		$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$54.51	$72.14
Apprentice	BHR	Percent										
First 6 months	$28.21	$80.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$47.46	$61.56
7-12 months	$29.97	$85.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$49.22	$64.21
13-18 months	$31.73	$90.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$50.98	$66.85
19-24 months	$33.50	$95.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$52.75	$69.50
25-30 months	$35.26	$100.00	$9.25	$9.60	$0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$54.51	$72.14

(*)Special Calculation Note :

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Adams, Allen, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Gallia, Greene, Guernsey, Hamilton, Hancock, Hardin, Harrison, Henry, Highland, Hocking, Holmes, Huron, Jackson, Jefferson, Knox, Lawrence, Licking, Logan, Lorain, Lucas, Madison, Mahoning, Marion, Medina, Meigs, Mercer, Miami, Monroe, Montgomery, Morgan, Morrow, Muskingum, Noble, Ottawa, Paulding, Perry, Pickaway, Pike, Portage, Preble, Putnam, Richland, Ross, Sandusky, Scioto, Seneca, Shelby, Stark, Summit, Trumbull, Tuscarawas, Union, Van Wert, Vinton, Warren, Washington, Wayne, Williams, Wood, Wyandot

Special Jurisdictional Note :

Details :

CLASS 2: Drivers on articulated dump trucks; rigid-frame rock trucks; distributor trucks; low boys/drag driver on the construction site only and heavy duty equipment (irrespective of load carried) when used exclusively for transportation on the construction site only.

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and other Division 01 Specification sections, apply to this Specification.

1.2 SUMMARY

A. Project:

B. Owner (DRC):

Jeremy Hyer
ODRC Project Manager
PO Box 430 Columbus
Ohio 43216

C. Architect:

GPD Group
520 S. Main St.
Akron, Ohio 44311

D. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Access to site.
5. Coordination with occupants.
6. Work restrictions.
7. Specification and drawing conventions.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents for the construction of the new LoCI Auto School Building includes the following:

1. The project is located at the London Correctional Institution (LOCI) in London, Ohio, and the new facility will be a PEMB building located outside of the secured perimeter of the institution. This project will entail construction of a new LOCI Auto-school facility and will include auto repair garage bays, classrooms, storage, offices, fire suppression and restroom with consideration for future expansion. Work will include structural, electrical, masonry, metals, carpentry, caulking, concrete/paving, site drainage, life safety, exterior envelope, HVAC, plumbing, security, and technology trades.

The Work consists of all supervision, labor, materials, equipment, transportation, verification of existing conditions, cutting and patching, removals, etc., as required

to complete repairs and replacement to/and of the above mentioned project, and other work as indicated on the Drawings and in these Specifications.

Contractor's Use of Premises: During construction, Contractor will have limited use of site indicated. Contractor's use of premises is limited only by Owner's right to perform work or employ other contractors on portions of Project and as follows:

1. The Contractor shall confine all operations (including storage of materials) on Owner's premises to areas authorized or approved by the Contracting Officer, or their designated representative.
2. Owner, or Owner's Tenant, may occupy premises during construction. Perform construction only during normal working hours (8 AM to 5 PM Monday thru Friday, other than holidays), unless otherwise agreed to in advance by Owner. Clean-up work areas and return to a useable condition at the end of each work period.

    a. Site to be kept clean and swept daily.

    b. It will be the Contractor's responsibility to provide proper protection from any infiltration of, or damage by, dust, dirt, and debris to the tenants and their possessions. Liability for failure to do so will be solely the responsibility of the Contractor. All work is to be performed in a manner which will cause minimal discomfort and inconvenience to the Owner or Tenants of the property.

B. Type of Contract

1. Project will be constructed under a single prime contract.

2. All trades to be coordinated with General Contractor to ensure complete installation to all applicable codes, manufacturers requirements, and manufacturer warranties.

C. Time of Completion of Work:

1. The total project shall be completed within **358** Contract days (approximately **255** working days) beginning immediately from the date stipulated in the "Notice to Proceed". The Prime Contractor will be expected to utilize whatever manpower is required to complete the work on schedule.

2. PEMB Submittals shall be submitted in early January 2026.

3. The contractor has the opportunity to start foundations prior to PEMB arriving to give time for building to be fabricated.

1.4 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.5 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to the areas necessary to complete the work shown on the drawings.
2. Driveways, Walkways and Entrances: Keep driveways and loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
3. Contractor does not need a gate pass – only if the contractor needs to see building that fiber resides in.
4. Tap in for the gas is inside the fence.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weather-tight condition throughout construction period. Repair damage caused by construction operations.

D. The contractor will proceed with project toward completion throughout fall and winter providing outside air temperature allows proper installation and maintaining livable conditions in the units. Project shall progress as long as temperature permits. Where cold weather requires, work shall temporarily halt.

1.6 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and existing building(s) during entire construction period, primarily in existing office areas. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.7 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 8 a.m. to 4:30 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: 8:30 a.m. to 4:30 pm actual working time, as allowed by management with 72 hours notice.
2. Early Morning Hours: As allowed by management with 72 hours notice.
3. Hours for Utility Shutdowns: To be determined during pre-construction meeting.
4. Hours for Core Drilling: To be determined during pre-construction meeting.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than five (5) days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Nonsmoking Building: Smoking is not permitted on OHARNG property

F. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

H. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

END OF SECTION 01 10 00

Institutional Security Orders and Expectations for Contractors

1

TO: THOSE CONCERNED

FROM: Major T. Venable, Chief Security Officer

THRU: A. Mohr, Warden

SUBJECT: London Correctional Institution

SECURITY ORDERS AND ENTRY PROCEDURES FOR CONTRACTOR'S & CONSTRUCTION PERSONNEL for DRC 23-L-009

DATE: 8/25/25

GENERAL INFORMATION: Entrance onto the Facility property will be at Post 1 (Main Entry) & Sallyport. All vehicles will stop and give the name(s) of all occupants and provide State-approved picture identification. Personal vehicles will be parked in a designated area outside the Facility with vehicles remaining locked at all times. All persons are subject to search upon entering or leaving the Facility. All vehicles are subject to "shake down" before entering or leaving Institution property. Therefore, all vehicles should be free of contraband. Vehicles for use in construction work will be allowed to be driven to the construction site, the number of vehicles allowed to enter the construction site may be limited by security guidelines. These vehicles will be escorted by Construction Escort Officer when the construction site is not maintained in an area separate from the main compound. The windows must be rolled up completely and the doors locked. The Construction Escort Officers will maintain custody of the keys for the vehicle and the required "Club" steering devices while inside the compound. Keys will be returned to the Rear Sallyport while the vehicle is being unloaded.

The Institutional Project Coordinator/Facilitator is the Maintenance Superintendent at extension 26228. If unable to contact that staff, leave a message on voice mail and your call will be returned. The Maintenance Superintendent should be contacted with day-to-day work plans of all contractors and Security should be informed on a daily basis whether or not Security escorts will be required.

The Security Coordinator will be the Chief Security Officer (Major) at phone extension # **26429** assisted by the Tool Control Officer at extension **26519.**

Institutional Security Orders and Expectations for Contractors

The Prime Contractor's Superintendent will be responsible for the conduct of his/her employees and those of any Subcontractor while on Institution property and will see that they abide by regulations set forth in these procedures.

BACKGROUND INVESTIGATIONS: All Contractors' employees, and their Subcontractor's employees, with the exception of a One-Time Service Contractor, shall submit a completed Contractor Application and a Release of Information form/packet to the Maintenance Superintendent. A background investigation will be conducted on each employee which shall include a LEADS check, Operator's License check and Local Law Enforcement check. The Institutional Investigator shall make recommendations to the Warden regarding a contract employee's eligibility to work within the institution or on its grounds. The Warden's decision is final. Contractor employees may be disqualified for felony convictions, domestic violence convictions, drug related convictions, dishonorable discharge and traffic violations that result in the applicant not possessing a valid driver's license. Contractor employees will not be granted entrance into the facility until background investigations are complete. All requests for investigations along with submission of all required documents shall be made at least 10 working days prior to the employee's first expected work date.

IDENTIFICATION CARDS: Based upon completion of an approved background investigation, Contractor employees who will be on-site on a regular basis will be issued an Institutional Contractor's identification badge. The Prime Contractor's Superintendents will be responsible for providing, to the Major, a listing of their employee's, and those of their Subcontractor, whom they expect to use regularly. A day will be scheduled when the employees will report to the institution identification office. They must present a State approved picture identification (e.g. drivers license) at which time a photo will be taken and an Institution Contractor's badge prepared. The badge will contain the employee's name, contractor's name, physical description, and information regarding escort status within the facility. Issuance of institution identification is at the discretion of the Warden and must be approved by the Major.

TRAINING: All Contractors' employees who are issued Contractor's badges will be required to undergo Contractor's Training per department policy and must sign the Declaration of Understanding on contraband. The training will be conducted in conjunction with the Institutional Training Office and scheduled before issuance of the Facility Contractor's badge.

CONSTRUCTION EMPLOYEE ENTRY:

Entry with Facility identification: The Contractor's badge will be issued and returned daily at the rear sallyport. The employees must present their driver's license or other state approved picture I.D. to the Sallyport or Post 1 officer. The license will remain at the entry point until the employee exits the facility. Contractors will document sign-in/sign-out times in the appropriate log. The Sallyport Officer will turn these logs in to the Deputy Warden

Institutional Security Orders and Expectations for Contractors

Of Operations on a regular basis. The contract employee must wear the Contractor's badge at all times while on Institution property. If a contractor's badge is missing or lost, the missing badge will be reported to the Construction Escort Staff immediately. The Escort Staff will notify Major. An incident report detailing the events surrounding the missing badge shall be written.

Entry without Facility identification: The Prime Contractor's Superintendent will be responsible for providing Maintenance with the names, social security number and date of birth of construction employees reporting to work on a one-time or occasional basis 5 working days prior to the employees anticipated start date. An authorized entrance form will be completed to allow entry for a specific date or dates. The construction employee will be required to provide a State approved picture identification that will be retained at the sallyport until the employee's departure from the institution. Contractors will document sign-in/sign-out times in the appropriate log. The Sallyport Officer will turn these logs in to the Deputy of Operations and the Major on a regular basis.

Contract Employees will not be admitted if they fail to provide a State approved picture I.D.

MATERIALS DELIVERY: Delivery of construction materials by vendors for the contractor to locations inside the compound will be through the rear Sallyport.
All drivers must provide a State Approved Driver's License. When appropriate, designated storage areas inside the institution perimeter will be determined on an as need basis and must be approved by the Tool Control Officer.
Material Storage trailers may be established at a mutually agreed upon location outside of the compound to facilitate bulk storage of materials and ease of delivery. Materials must be stored inside trailers or stacked neatly on pallets. Trash, construction debris and junk shall be removed from the storage site daily, dumpsters are only allowed to exit the facility during count time (after cleared).

At no time shall construction materials be delivered to the Institution Warehouse or Mailroom. The staff has been advised to refuse delivery. Any emergency or overnight deliveries shall be made to the contractor's outside storage trailer and the contractor shall be available to accept delivery.

VEHICLES: Personal vehicles will not be allowed inside the compound without approval of the Major. Construction vehicles will not be left inside the institution compound unless their presence is required to complete the work for the day. The vehicle may enter the compound to unload materials and tools then shall be removed until the end of the work day. Vehicles left unattended while inside, or outside the compound will be locked and

Institutional Security Orders and Expectations for Contractors

The windows rolled up in an authorized parking area. Vehicles left unattended inside the compound during normal working hours will be disabled by placing a club or chain on the steering wheel.

If a vehicle is to remain inside the institution for a period of 30 minutes or longer a staff member shall take the vehicle keys to the sally port for the duration of the delivery/pickup. The keys will then be secured in a lock box inside the sally port until the vehicle is ready to leave the grounds.

An allowance of 15 minutes should be expected for each passage thru the drive thru perimeter sally port, delays exceeding this should be discussed at progress meetings. All dumpsters exiting the institution should be scheduled during count times so a cleared institution count is declared just prior to exiting.

EQUIPMENT: Entry of large construction equipment such as track hoes; cranes, etc. require approval in advance. **This equipment must be removed from inside the compound every day** unless prior approval is received from the Tool Control Officer. If approval is granted for equipment to remain inside, the ignition system must be disabled and buckets or lifts secured in a manner to prevent operation under any circumstances. No motor vehicles shall be allowed to remain overnight inside the inner perimeter of the institution without being properly disabled.

MEALS: All Contractors should be prepared to bring their own lunch. The Rear Sallyport is busy and we must limit traffic flow into this area. Lunch cooler's which enter the institution are subject to shakedown and must be clear. Food items should be in original packaging or in see through containers in accordance with the Institutional procedures.

TOOL CONTROL: Tool control of construction company tools will be controlled by the Contractors' Superintendents, their designees and the Construction Escort. The Contractor will provide accurate, up to date tool inventories to the job site storage boxes or area, Escorting Officer and the Tool Control Officer.
Under the established tool control system, tools and equipment will be divided into two categories: Permanent and Temporary.

Permanent tools and equipment that are to remain at the job site indefinitely shall be inventoried on form 2331 "Tool Inventory" with copies being maintained at the building site with the tools and with the Tool Control Officer. When not in use and at the end of each construction day, tools and equipment shall be secured in a job box or other security cage within the building. Exceptions may be granted for unreasonably large equipment by the Tool Control Officer. Any changes to the permanent inventory (additions, deletions) shall result in a revised inventory submittal. Tools will be inventoried twice daily (once in the morning and again at the end of the workday). Tools

need to be accounted for at the end of the shift and day by documenting on form 2332 "Daily / Weekly Tool / Equipment Report." The assigned escorting officer shall maintain and provide this documentation.
All Ladders and Aerial Lifts must be removed daily and are not permitted to remain in the institution. Certain situations and requests may be reviewed by the Major and approved by the Regional Director. These requests will be kept to a minimum.

Temporary tools and equipment, which may include personal tools, are those which will be transported into the institution daily by the contractor. The contractor shall submit a daily tool list on form 2331 "Tool Inventory" that shall also be retained in the tool box or area at the building site and the Tool Control Officer.
Only one Contractor Cell phone will be allowed inside the compound, the carrier and phone number must the cell phone be provided to institution security staff prior to bringing it into the facility.
Contractor's tool control procedures will be inspected periodically by the Institutions' Tool Control Officer. Contractors shall follow any recommendations from the Tool Control Officer in order to ensure the security of the Facility. Any questions a contractor may have with regard to tool issues may be addressed with the Tool Control Officer (extension **26432**)
Tools are to be checked no less than once per day to verify all tools are accounted for. If a tool or equipment is missing or lost, the contractor shall immediately notify the assigned Construction Escort Officer.

CHEMICAL CONTROL: All chemicals brought onto state property must have prior approval by the institution's Safety Officer prior. An accurate inventory with approval documentation and an updated SDS must be maintained with the chemicals.

MEDICATIONS: Construction or outside employees are reminded that they should only bring the amount of medication that is necessary and will be consumed by the person on that particular day. Persons having medication in their possession shall provide information for the medication log sheet, including the name and amount. If medication conveyed into the institution has not been prescribed for that individual by a doctor, the person conveying such medication is subject to prosecution in accordance with the Ohio Revised Code and also barred from Institution grounds.

WEAPONS: Construction employees will not convey onto the grounds of this Institution any deadly weapons or dangerous ordinance; if found on/with an employee, they will be subject to O.R.C. Section 3719.011.

INTOXICANTS: Intoxicating beverages conveyed onto Institution property will cause the

Institutional Security Orders and Expectations for Contractors

Individual to be subject to O.R.C. Section 4301.01.

DRUGS: Drugs conveyed on grounds of Institution property will cause the individual to be subject to O.R.C Section 3719.01.

TOBACCO: ODRC and OCF is a tobacco free work environment. No tobacco products are to be used on state grounds.

FRATERNIZATION: No construction employee will fraternize with, give or take any items from an inmate confined in an Institution. If an employee is approached by an inmate, for any reason, the employee will report this information to the Construction Escort and he will, in turn, report this to the Special Duty or Shift Captain. Also, any construction employee having acquaintances or relatives confined at this facility is to notify the Institution by completing an Inmate Nexus form and incident report detailing how you know or are related to the inmate.

LOST ARTICLES: If, at any time, a construction employee loses an item, regardless of what it is, inside the Institution compound or on Institution grounds, the employee will report the lost item (i.e., car keys, tools, knives, etc.) and where it was lost, to the Escort **IMMEDIATELY!**

DEBRIS: All debris and scrap material will be transported outside the Facility compound at the end of each workday.

EMERGENCY: If an emergency should occur while construction workers are inside Institution grounds, these workers will remain at the site, and will be evacuated when appropriate, by Institution personnel. An Emergency Site plan that has been modified to coordinate with the institution's policies and approved by the institution safety officer must be posted at the job site.

COUNTS: Regularly scheduled counts of inmates are conducted throughout the day to insure inmate accountability. Contractors may enter and exit during normal counts. If the institution is not able to clear the count within a reasonable time period, a Special Count will

be called. Counts occur at the following times during a contractor's normal workday: 11:00 a.m. and 4:00 p.m.

SPECIAL COUNTS: If a special count is in process at the completion of the contractor's workday, they will be required to remain at the job site or other area designated by the institutional policy until the Institutional count clears.

STAFF ACCOUNTABILITY: In order to account for all staff and any other civilians within the facility in the event of an emergency, the Institution on occasion will conduct an

Institutional Security Orders and Expectations for Contractors

Exercise in staff accountability (referred to as a Signal 24). Contractor's will need to follow the direction of their escort officer and may be required to report to another location in order to be accounted for.

WORK HOURS: Contractors' normal scheduled work hours will be (7am-5pm) Four 10-hour days (Tuesday through Friday)
No work will be allowed during State observed Holidays.

WORK AREAS / SITES: The number of construction crews that could be accommodated during approved schedule is **two work sites, with 2 escorts not to exceed (inside the institution work)** 20 Construction Workers. Not to include the additional front entry officers placed by the institution during renovation of the front entry area.
Work performed outside the secure perimeter is subject to prison local policy and guidelines depending on location and nature of work. This work should not have sallyport passage time accounted for and will generally be less.

MOTOR VEHICLES: No person is authorized to operate a motor vehicle on Institutional grounds without a Valid State Driver's License.

DRESS CODE: Any type of clothing or body marking that is inflammatory and/or known as a gang insignia is prohibited from being displayed inside the institution. This includes the wearing of blue, red or black bandanas as a cap or sweatband. Shorts are prohibited. Shirts are required. Light blue shirts worn in conjunction with blue jeans or pants should be avoided to reduce the possibility of being mistaken for an inmate.

OTHER SECURITY ISSUES: In the event of an emergency or due to unexpected staffing shortages or security issues a contractor may be denied entry or asked to leave the institution. The Contractor's Superintendent shall verify the condition through the Maintenance Superintendent or a Shift Supervisor.
No weapons including CCW permit holders are to be brought onto state property**.** It is the contractor's responsibility to notify all delivery drivers, sub-contractors and anyone else that they will have on site of this prior to their arrival.

Institutional Security Orders and Expectations for Contractors

London Correctional Institution
Construction Security Orders and Entry Procedures
Acknowledgement Form

I acknowledge that I have received and read a copy of the London Correctional Institution **Security Orders and Entry Procedures For Contractor & Construction Personnel.** I have had the opportunity to ask questions relating to any areas of the document for which I need clarification. If any type of security issues or questions arise while I am working at the London Correctional Institution, I will immediately contact the Correctional Officer assigned or the Administrative Assistant of Construction and Maintenance to clarify the situation. I understand that violation of the Security Orders and Entry procedures may result in permanent removal from Facility grounds.

_____
Contractor's Name (Print)

_____
Contractor's Signature Date

_____
Witness's Signature Date

Ohio Department of Rehabilitation and Correction

Background Investigation Checklist

Applicant Name:

Section 1
General Information

	Initials	Date
Driver License/State ID		
MRDD Abuse Registry https://odmrdd.state.oh.us/epps/internet/abs/nbs/abuse_default.aspx		
DOTS Portal - Inmate Visiting List		

Section 2
Fingerprints

	Initials	Date
BCI & I		
FBI		

LEADS

	Initials	Date
DS (Driver's & SSN)		
ZSO or SER		
QR		
Other		

Local Law Enforcement

(form DRC1673)

	Initials	Date
Residence - City		
Residence - County		
Employment - City		
Employment - County		
Educational - City		
Educational - County		

Section 3
Education

	Initials	Date
High School/GED		
Certified College Transcript		
Certification/Licensure		

Notes:

Section 4
Personal Reference

(form DRC1678)

	Initials	Date
Personal Reference		
Personal Reference		

Notes:

Employment

(form DRC1676)

	Initials	Date
Current - Employer		
Employer		
Employer		
Employer		
Employer		
Employer		
Employer		
Employer		

Supporting documentation must be attached.

Background Investigation Completed by:

Investigator's Signature:	Date:

Denied: ☐ Reason for denial:

Approved: ☐

Appointing Authority/Designee:	Date:

Ohio Department of Rehabilitation and Correction

Authority for Release of Information

Last Name:	First Name:	Middle Name:	Other names used or known by:	Last Four (4) Digits of SSN:

Street Address:	City:	County:	State:	Zip Code:

Phone Number:	Driver's License No.:	State of Issue.:	Place of Birth (county or city, state, country):

Personal Email Address:	Sex:	Race:	State of Ohio User ID Number: (If applicable)	Date of Birth (m/d/y):

I, authorize a review and full disclosure of all records, or any part thereof, concerning myself, by and to **any** duly authorized agent of the Ohio Department of Rehabilitation and Correction, whether the said records are of public, private, or confidential nature.

The intent of this authorization is to give my consent for full and complete disclosure of the records of all educational institutions, courts, police agencies, present and previous employment to include pre-employment records, background reports, efficiency ratings, discipline records, termination records, complaints or grievances filed by or against me, and salary records.

The intent of this authorization is to provide full and free access to the background and history of my personal life, for the specific purpose of pursuing a background investigation which may provide pertinent data for the Ohio Department of Rehabilitation and Correction to consider in determining my suitability for worksite entry to provide contracted services, volunteer services, or for employment by that department. It is my specific intent to provide access to personal information, however personal or confidential it may appear to be, and the sources of information specifically identified herein.

I understand that any information obtained by a personal history background investigation which is developed directly or indirectly, in whole or in part, upon this release authorization will be considered in determining my suitability for worksite entry to provide contracted services, volunteer services, or for employment by the Ohio Department of Rehabilitation and Correction. I understand that all materials pertaining to this background investigation become the property of the Ohio Department of Rehabilitation and Correction and will not be returned to me.

I hereby give permission and waive all provisions of company policy and law forbidding any school, court, police agency, employer, firm or person, from disclosing any knowledge or information they have concerning me. I agree to indemnify and hold harmless the person to whom this request is presented and his or her agents and employees, for and against all claims, damages, losses, and expenses, including reasonable attorney's fees, arising out of or by reason of complying with this request. (see ORC 4113.71, Employer immunity as to job performance information disclosures, on the reverse of this form.) I further understand that in the event my application is disapproved, the sources of confidential information cannot be revealed to me.

A photocopy of this release form will be valid as an original hereof, even though the said photocopy does not contain an original writing of my signature.

Signature:	Date:

Ohio Department of Rehabilitation and Correction
Prison Rape Elimination Act
Background Check Authorization

Pursuant to the Prison Rape Elimination Act, the Ohio Department of Rehabilitation and Correction (ODRC) is required to take certain steps to ensure compliance with the law with respect to those who may have contact with inmates. Specifically, pursuant to 28 CFR 115.17 (e):

> The agency shall either conduct criminal background records checks at least every five years of current employees and contractors who may have contact with inmates or have in place a system for otherwise capturing such information for current employees.

I hereby acknowledge the requirement for ODRC to conduct a criminal background record check and authorize any duly authorized agent of ODRC to conduct the criminal background record check as required by law. I understand that all materials pertaining to this background check become the property of ODRC and will not be returned to me but will be maintained in a secure manner in accordance with applicable laws and policies.

This authorization shall remain valid for the duration of my employment with ODRC. A photocopy of this authorization form will be valid as an original hereof, even though the said photocopy does not contain an original writing of my signature.

Last Name:	First Name:	Middle Name:	Other names used or known by:	Last Four (4) Digits of SSN:

Street Address:	City:	County:	State:	Zip Code:

Driver's License No.:	State of Issue.:	Place of Birth (county or city, state, country):

Sex:	Race:	State of Ohio User ID Number: (If applicable)	Date of Birth (m/d/y):

Signature:	Date:

§ 4113.71

Employer immunity as to job performance information disclosures.

(A) As used in this section:

(1) "Employee" means an individual currently or formerly employed by an employer.

(2) "Employer" means the state, any political subdivision of the state, any person employing one or more individuals in this state, and any person directly or indirectly acting in the interest of the state, political subdivision, or such person.

(3) "Political subdivision" and "state" have the same meanings as in section 2744.01 of the Revised Code.

(B) An employer who is requested by an employee or a prospective employer of an employee to disclose to a prospective employer of that employee information pertaining to the job performance of that employee for the employer and who discloses the requested information to the prospective employer is not liable in damages in a civil action to that employee, the prospective employer, or any other employer is not liable in damages in a civil action to that employee, the prospective employer, or any other person for any harm sustained as approximate result of making the disclosure or of any information disclosed, unless the plaintiff in a civil action establishes, either or both of the following:

(1) By a preponderance of the evidence that the employer disclosed particular information with the knowledge that it was false, with the deliberate intent to mislead the prospective employer or another person, in bad faith, or with malicious purpose;

(2) By a preponderance of the evidence that the disclosure of particular information by the employer constitutes an unlawful discriminatory practice described in section 4112.02, 4112.021 [4112.02.1], or [4112.02.2] of the Revised Code.

(C) If the court finds that the verdict of the jury was in favor of the defendant, the court shall determine whether the lawsuit brought under division (B) of this section constituted frivolous conduct as defined in division (A) of section 2323.51 of the Revised Code. If the court finds by a preponderance of the evidence that the lawsuit constituted frivolous conduct, it may order the plaintiff to pay reasonable attorney's fees and court costs of the defendant.

(D)(1) This section does not create a new cause of action or substantive legal right against an employer.

(2) This section does not affect any immunities from civil liability or defenses established by another section of the Revised Code or available at common law to which an employer may be entitled under circumstances not covered by this section.

HISTORY: 146 v H 44. Eff 7-3-96.

The provisions of § 2 of HB 44 (146 v --) read as follows:

SECTION 2. Section 4113.71 of the Revised Code, as enacted by this act, shall apply only to cause of action against employers, as defined in the section, for harm that allegedly arises from the disclosure of job performance information pertaining to an employee, as defined in that section, which occurs on or after the effective date of this act. With respect to causes of action against employers for harm that allegedly arose from a disclosure of job performance information pertaining to an employee prior to the effective date of this act, the liability or immunity from liability of an employer and the defenses available to an employer shall be determined as if section 4113.71 of the Revised Code has not been enacted.

Ohio Department of Rehabilitation and Correction

Contractor/Volunteer/Intern Supplemental Questionnaire

Applicant Name: _____ Last Four (4) Digits of Social Security No.: _____

1. Have you ever been convicted of O.R.C. 2909.22, 2909.24, and/or 2909.29; Soliciting or providing support for an act of terrorism, Terrorism, or money laundering in support of terrorism?
   ☐ Yes ☐ No
2. Have you ever been accused of an inappropriate or unauthorized relationship in a prison, jail, lockup, community confinement facility, juvenile facility or other institution?
   ☐ Yes ☐ No
3. If you answered yes to the above question, please indicate the Employer, Dates of employment, Allegation, and Outcome. If no, write N/A.
4. Have you ever been accused of sexual abuse or resigned from employment during a pending investigation of an allegation of sexual abuse?
   ☐ Yes ☐ No
5. If you answered yes to the above question please indicate the Employer, Dates of employment, Allegation, and Outcome. If no, write N/A.
6. Have you ever been accused of sexual harassment?
   ☐ Yes ☐ No
7. If you answered yes to the above question please indicate the Employer, Dates of employment, Allegation, and Outcome. If no, write N/A.
8. Have you ever been civilly or administratively adjudicated or convicted of engaging or attempting to engage in sexual activity in the community facilitated by force, overt or implied threats of force, or coercion, or if the victim did not consent or was unable to consent or refuse?
   ☐ Yes ☐ No
9. If you answered yes to the above question please indicate the Location of adjudication or conviction, Date of adjudication and/or conviction, Allegation, and Outcome. If no, write N/A.
10. Have you ever been accused of or been convicted of O.R.C. 2921.36; Illegal conveyance of weapons, drugs, or other prohibited items onto the grounds of a detention facility or institution?
    ☐ Yes ☐ No
11. If you answered yes to the above question please indicate the Employer, Date of employment, Allegation and Outcome. If no, write N/A.
12. Have you ever knowingly accessed confidential personal information in violation of a rule of a state agency; or knowingly used or disclosed confidential personal information in a manner prohibited by law?
    ☐ Yes ☐ No
13. If you answered yes to the above question please indicate the Employer and/or location, Location, Date, and Outcome. If no, write N/A.

Applicant Signature:	Date:

Each question must be answered

Staff Nexus

Definition of Staff Nexus - An employee, volunteer or contractor who has any contact and/or relationship with an inmate or offender who is currently under supervision of DRC.

Notice: If the relationship changes you are required to complete a new nexus form immediately.

Name _____ Job Title _____

Your OAKS Number: _____

Your Current Work Location: _____

COMPLETE ONLY ONE SECTION BELOW (I, II OR III)

I ☐ NO NEXUS

I state that, to the best of my knowledge, I have no nexus connection, affiliation, or relationship to any inmate/offender currently under the supervision of the the Ohio Department of Rehabilitation and Correction. I understand that should I become aware of such a relationship I am required to notify my Managing Officer/ APA Regional Administrator the next business day.

II ☐ NEXUS - REQUESTING NO CONTACT *(Select one of the 2 options below and explain below)*

I do have a nexus I am required to report, but I do not wish to correspond, visit, send funds/packages or communicate with them while they are incarcerated or on under community supervision.

Offender Name: _____

Offender Number: _____

☐ I do not anticipate professional conflict if the individual remains in the same prison/APA region.

☐ I anticipate a professional conflict if the individual remains in the same prison/APA region

Please Note: In some cases, inmates with certain medical, mental health, classification, security, supervision or other needs will required the inmate to be kept in a certain prison/region. In situations where inmates cannot be moved for these reasons, requests to not work in the same facility/region with the inmate cannot be accommodated.

Please describe your relationship and the reason you anticipate a professional conflict:

III ☐ NEXUS - REQUESTING CONTACT

I have a nexus with the inmate/offender listed below who is currently incarcerated in the ODRC or under the supervision of the APA and I wish to maintain contact with them.

Offender Name: _____

Offender Number: _____

Please describe your relationship and the purpose and extent of the contact:

Staff

Print Name:	Signature:	Date:

Managing Officer Action:

☐ Approve No Contact - Transfer ☐ Approve Contact

☐ Approve Professional Contact Only - No Transfer ☐ Disapprove Contact

Print Name:	Signature:	Date:

Ohio Department of Rehabilitation and Correction

INDEPENDENT CONTRACTOR INFORMATION

EXPLANATION AND INSTRUCTION: This questionnaire will provide the Ohio Department of Rehabilitation and Correction with information needed to determine your eligibility for approval as an independent contractor. Please answer all questions fully, truthfully, and accurately. If any questions are not answered, attach a written statement specifying the reasons therefore. Falsification will result in your bid being disqualified.

Please Print/Type Name

1.	Full Name: First	Middle	(Maiden)	Last
2.	Your Address:			
3.	Last four (4) Digits of Social Security Number:	Telephone Number (with area code):	Personal Email Address:	
4.	Person to notify in case of emergency:	Relationship:	Telephone # with Area Code:	

5. Have you ever been employed with the State of Ohio, Department of Rehabilitation and Correction or Adult Parole Authority? ☐ Yes ☐ No

If yes, where and when? _____

6. Do you have any open cases or pending charges in any jurisdiction? ☐ Yes ☐ No

please explain (what, when, where, next court date)

7. Have you ever been convicted of a misdemeanor? ☐ Yes ☐ No

Conviction:	State of Conviction:	Court of Conviction:
Date of Conviction:		
Conviction:	State of Conviction:	Court of Conviction:
Date of Conviction:		

8. Have you ever been convicted of a felony? ☐ Yes ☐ No

Conviction:	State of Conviction:	Court of Conviction:
Date of Conviction:		

Conviction:	State of Conviction:	Court of Conviction:
Date of Conviction:		

9. Have you ever been committed to or confined in any correctional institution? ☐ Yes ☐ No

If yes, when? Where? _____ (when) _____ (where)

10. Have you ever been or are you now on probation or parole? ☐ Yes ☐ No

If yes, when? Where? _____ (when) _____ (where) How Long? _____

11. Are you presently an approved visitor or have you ever visited an offender confined in a penal institution within Ohio? (name/number, location, date) ☐ Yes ☐ No

Name	Number	Location

12. Are you in communications or have a personal relationship with any offender presently incarcerated with Ohio Department of Rehabilitation and Correction or under the supervision of the Adult Parole Authority? ☐ Yes ☐ No

Name	Number	Relationship	Place of Incarceration/Supervision

13. Are you in communications with or have a personal relationship with an offender currently incarcerated or under supervision in another state? (State, name/number, facility) ☐ Yes ☐ No

State	Name	Number	Facility

14. Does this position require a license? ☐ No ☐ Yes

If Yes, indicate license number and verification.

15. Please list all jobs (including part-time, temporary, and voluntary positions) you have held in the past 12 months. For identification and verification, please indicate the nature of the activity, i.e. full-time, part-time, or voluntary. If you have had intervening periods of military service or unemployment, please list those periods in sequence in the spaces provided.

☐ Full-time ☐ Part-time ☐ Voluntary

Date of Employment (From [M/Y] To [M/Y]):	Name and Address of Employer:	
Telephone Number:	Name of Supervisor:	Name(s) of co-worker(s):
Title or Duties (for identification purposes):	Reason for Leaving:	

☐ Military Service ☐ Not Employed

From (Mth/Year):	To (Mth/Year):

☐ Full-time ☐ Part-time ☐ Voluntary

Date of Employment (From [M/Y] To [M/Y]):	Name and Address of Employer:	
Telephone Number:	Name of Supervisor:	Name(s) of co-worker(s):
Title or Duties (for identification purposes):	Reason for Leaving:	

☐ Military Service ☐ Not Employed

From (Mth/Year):	To (Mth/Year):

☐ Full-time ☐ Part-time ☐ Voluntary

Date of Employment (From [M/Y] To [M/Y]):	Name and Address of Employer:	
Telephone Number:	Name of Supervisor:	Name(s) of co-worker(s):
Title or Duties (for identification purposes):	Reason for Leaving:	

☐ Military Service ☐ Not Employed

From (Mth/Year):	To (Mth/Year):

☐ Full-time ☐ Part-time ☐ Voluntary

Date of Employment (From [M/Y] To [M/Y]):	Name and Address of Employer:	
Telephone Number:	Name of Supervisor:	Name(s) of co-worker(s):
Title or Duties (for identification purposes):	Reason for Leaving:	

☐ Military Service ☐ Not Employed

From (Mth/Year):	To (Mth/Year):

By signing below, the vendor agrees to abide by all agency policies, particularly those relating to confidentiality of information and security practices.

Vendor Signature:	Date:
☐ Approved ☐ Disapproved Appointing Authority:	Date:

Declaration of Understanding

The Ohio Department of Rehabilitation and Correction has a zero tolerance for the conveyance of drugs, alcohol, and weapons into its correctional institutions. Any such act will constitute a violation of section 2921.36 of the Ohio Revised Code which states in part that "No person shall knowingly convey, or attempt to convey, onto the grounds of a detention facility (including prisons, owned and operated by the Ohio Department of Rehabilitation and Correction) or of an institution that is under the control of the department of mental health or the department of mental retardation and developmental disabilities, any of the following items:

(1) Any deadly weapon or dangerous ordnance, or any part of or ammunition for use in such deadly weapon or dangerous ordnance;

(2) Any drug of abuse, as defined in section 3719.011 of the Revised Code;

(3) Any intoxicating liquor, as defined in section 4301.01 of the Revised Code;

(4) Cash;

(5) Cellular telephone, two-way radio, or other electronic communication device.

(6) Any product that contains tobacco including but not be limited to cigarettes, loose tobacco, cigar, snuff, chewing tobacco, or any other preparation of tobacco, tobacco substitutes, smoking paraphernalia (i.e., matches, lighter, cigarette papers, and rolling machine)

Every effort will be made to prosecute to the fullest extent of the law, any person found to be in violation of this section of the Ohio Revised Code.

I have read or it has been read to me, and I understand the above declaration. I will not bring any weapon, dangerous ordnance, ammunition, drug, intoxicating liquor, cash, cellular telephone, two-way radio, or electronic communication device into the prison.

☐ Visitor ☐ Contractor

☐ Volunteer ☐ Other

Name (typed or printed):	
Signature:	Date:
Witness:	Date:

SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain work may be specified in the Contract Documents by allowances.

B. Allowance's are for reimbursable services, products and or equipment only.

1.3 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified by the Owner.
1. Invoices or receipts for reimbursement are required to use the allowance amount for reimbursement.

1.4 ALLOWANCES

A. Use the allowances only as directed by the Owner and only by written orders that indicate amounts to be charged to each designated allowance.

B. Contractor's related costs for products, services and equipment ordered by Owner under the allowances are included in the allowances and are part of the base bid contract sum. These costs are inclusive and include but not limited to delivery, installation, insurance, equipment rental costs, mobilization, staging, labor, materials and all similar related costs.

C. At Project close-out, a reconciliation of allowances shall be conducted to account for all monies used under the allowances. Any unused amounts remaining in the allowances shall be unilaterally deducted from the total contract amount.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Notify the A/E and owner when an allowance is needed before it is utilized. Coordinate services, products and or equipment and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

1. Notify the AE and owner when an allowance is needed before it is utilized.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Lump-Sum Allowance: $170,000.

1. This allowance is for the cost of undercutting and removing unsuitable subgrade soils and replacing with TX 160 Geogrid and ODOT 304 aggregate base material, as directed by the engineer. The limits will be determined in the field by the engineer and quantified. Pricing shall be determined by field measured quantities and unit pricing provided in section "01 22 00 – Unit Prices."

2. This allowance includes material cost, receiving, handling, installation, and Contractor overhead and profit.

SECTION 01 22 00 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:
1. Section 01 40 00 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

1. The contractor needs to get approval for the number of units needed prior to doing the work. and also needs to prove the need for the number of units needed (photos, AE observation, etc.).

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

1. Verify need to use the number of units and get approval prior to doing the work involved with unit pricing, etc.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. A:
   1. Description: This quantity is for use for the cost of undercutting and removing unsuitable subgrade soils and replacing with TX 160 Geogrid and ODOT 304 aggregate base material, as directed by the engineer.
   2. Unit Cost per 24" deep SY: _____/SY
   3. Unit of Measurement: Square Yard

SECTION 01 22 00

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Canopy
   1. Provide add alternate price to provide Entrance canopies at storefront.
   2. See Architectural Elevations and Roof plan.

B. Alternate No. 2: Masonry Wainscot
   1. Provide add alternate price to provide 4'H Exterior masonry Base Wall
   2. See Architectural elevations

C. Alternate No. 3: Building Color
   1. Provide add alternate price to provide additional exterior paint region
   2. See Architectural elevations

D. Alternate No. 4: Clerestory Windows
   1. Provide add alternate price to provide additional exterior windows
   2. See Architectural elevations

E. Alternate No. 5: Office Casework & Plumbing
   1. Provide add alternate price to provide casework and associated sink plumbing within Office 106
   2. See Architectural Floor and plumbing plans.

END OF SECTION

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
   1. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.

   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

   1. Substitution Request Form: Use form acceptable to Architect.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

      a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
      b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect

will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
   1. Section 01 21 00 "Allowances" for procedural requirements governing the handling and processing of allowances.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

   1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
   3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
   4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
   5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract, as described in Section 01 10 00 "Summary."

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

   1. Identification: Include the following Project identification on the schedule of values:

      a. Project name and location.

b. Owner's name.
c. Owner's Project number.
d. Name of Architect.
e. Architect's Project number.
f. Contractor's name and address.
g. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

    a. Related Specification Section or division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.

        1) Labor.
        2) Materials.
        3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site.

6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
7. Purchase Contracts: Provide a separate line item in the schedule of values for each Purchase contract. Show line-item value of Purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
8. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
9. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
10. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
11. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
12. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and paid for by Owner.

B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: Submit Application for Payment to Architect by the <Insert day> of the month. The period covered by each Application for Payment is one month, ending on the [last day of the month] <Insert specific day of the month>.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.

D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

1. Other Application for Payment forms proposed by the Contractor may be acceptable to Architect and Owner. Submit forms for approval with initial submittal of schedule of values.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment, subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Sustainable design action plans, including preliminary project materials cost data.
7. Schedule of unit prices.
8. Submittal schedule (preliminary if not final).
9. List of Contractor's staff assignments.
10. List of Contractor's principal consultants.
11. Copies of building permits.
12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
13. Initial progress report.
14. Report of preconstruction conference.
15. Certificates of insurance and insurance policies.
16. Performance and payment bonds.
17. Data needed to acquire Owner's insurance.

I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

    a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."

2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. AIA Document G706.
6. AIA Document G706A.
7. AIA Document G707.
8. Evidence that claims have been settled.
9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
10. Final liquidated damages settlement statement.
11. Proof that taxes, fees, and similar obligations are paid.
12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Requests for Information (RFIs).
3. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:
1. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
2. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.
3. Section 01 33 00 "Submittal Procedures" for requirements of shop drawings and submittals.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail

addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list to Owner, Architect, Property Manager and Inspector. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Contractor shall coordinate regular meetings with subs and submit meeting minutes.
3. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
4. Make adequate provisions to accommodate items scheduled for later installation.

B. Contractor's Construction Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart- type schedule within 10 days of date established for commencement of the Work. Distribute copies to Owner, Contracting Officer, or their designated representative, subcontractors, testing and inspecting agencies, and all other parties required to comply with dates.

1. Provide a separate time bar for each activity, using same breakdown of Work indicated in the Schedule of Values, and a vertical line to identify the first workday of each week.
2. Coordinate each element with other activities. Show each activity in proper sequence. Indicate sequences necessary for completion of related Work.
3. Indicate Substantial Completion and allow time for the Contracting Officer's, or their designated representative's, procedures necessary for certifying Substantial Completion.
4. Revise the schedule after each meeting or activity where revisions have been made. As Work progresses, mark each bar to indicate actual completion.
5. Reissue schedule, and/or as otherwise required to all parties with schedule responsibilities.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.

6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified, but will be required to formally submit on OAKS website.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect. All RFI’s to be formally submitted on OAKS website.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow three (3) working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for approval of Contractor's means and methods.
d. Requests for coordination information already indicated in the Contract Documents.
e. Requests for adjustments in the Contract Time or the Contract Sum.
f. Requests for interpretation of Architect's actions on submittals.
g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.

E. RFI Log: Architect shall Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. On receipt of Architect's action, the RFI log shall be updated and immediately distributed to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

A. General: The Architect will schedule and conduct meetings and conferences at Project site unless otherwise indicated.

B. Preconstruction Conference: The Owner will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. The Architect will Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.
b. Critical work sequencing and long-lead items.
c. Designation of key personnel and their duties.
d. Lines of communications.
e. Procedures for processing field decisions and Change Orders.
f. Procedures for RFIs.

g. Procedures for testing and inspecting.
h. Procedures for processing Applications for Payment.
i. Distribution of the Contract Documents.
j. Submittal procedures.
k. Preparation of record documents.
l. Use of the premises and existing building.
m. Work restrictions.
n. Working hours.
o. Owner's occupancy requirements.
p. Responsibility for temporary facilities and controls.
q. Procedures for moisture and mold control.
r. Procedures for disruptions and shutdowns.
s. Construction waste management and recycling.
t. Parking availability.
u. Office, work, and storage areas.
v. Equipment deliveries and priorities.
w. First aid.
x. Security.
y. Progress cleaning.

4. Minutes: The Architect is responsible for recording and distributing meeting minutes.

C. Project Closeout Conference: Architect will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 15 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for preparing operations and maintenance data.
e. Requirements for delivery of material samples, attic stock, and spare parts.
f. Requirements for demonstration and training.
g. Preparation of Contractor's punch list.
h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
i. Submittal procedures.
j. Owner's partial occupancy requirements.
k. Installation of Owner's furniture, fixtures, and equipment.
l. Responsibility for removing temporary facilities and controls.

4. Minutes: Architect will record and distribute meeting minutes to everyone.

D. Progress Meetings: Conduct progress meetings at weekly intervals.
1. Attendees: Representatives of the Owner, Architect, and General Contractor. Subcontractors, material suppliers, and other parties involved in the execution of the project shall attend by special request from the contractor. All participants shall be familiar with project and shall be authorized to conclude matters relating to the work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

        1) Review schedule for next period.

    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Progress cleaning.
        10) Quality and work standards.
        11) Status of correction of deficient items.
        12) Field observations.
        13) Status of RFIs.
        14) Status of proposal requests.
        15) Pending changes.
        16) Status of Change Orders.
        17) Pending claims and disputes.
        18) Documentation of information for payment requests.

3. Minutes: The Architect is responsible for recording and distributing the meeting minutes to each party present and to parties requiring this information.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

Section 01 32 16 - Construction Progress Schedule
State of Ohio Standard Forms and Documents

PART 1 GENERAL

1.01 SUMMARY

A. The purpose of the Construction Progress Schedule is to allow the Schedule Manager to prepare an orderly plan to aid in the timely completion of the Project.

1. For clarity, this Section uses the term Schedule Manager for activities performed by the Lead Contractor's Schedule Consultant, the Lead Contractor, the Construction Manager, or the Contractor depending on the party with contractual responsibility for their timely completion in accordance with paragraph 4.2.3 of the applicable General Conditions.

B. The approved Construction Progress Schedule will be used to plan and execute the work, to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis for all progress payments.

C. Contractors shall cooperate and coordinate with each other, and with the A/E and the Owner, to provide all scheduling requirements in their respective schedules in accordance with the Contract Documents.

D. Failure to maintain the Construction Progress Schedule in an approved status may result in the Contracting Authority withholding a monetary penalty against the responsible Contractor(s) until the schedule is approved.

E. Related Sections:

1. Division 00 Document - General Conditions (Paragraphs 4.2 and 4.3)

2. Division 00 Document - Supplementary Conditions (if applicable)

1.02 PROJECT SCHEDULING SEQUENCE REQUIREMENTS

A. The Schedule Manager will prepare a Construction Progress Schedule for all work included under the scope of each Contract, in accordance with Subparagraph 4.3.2 of the General Conditions.

1. The Schedule Manager will schedule and conduct a Schedule Kick-Off Meeting. Contractors are required to attend.

a. The Schedule Manager will prepare and furnish to all contractors a Master Activity Coding template, in hard copy and disk, defining the Responsibility Code, Work Area Code, Milestones, Phase Code, etc. for the Construction Progress Schedule, as outlined in this section. Contractors shall submit subsequent schedule requirements in accordance with the Master Activity Code template to achieve continuity in merging scheduling input.

b. The Schedule Manager will prepare and distribute a schedule framework of proposed construction sequence to the Contractors.

2. The Schedule Manager will prepare and furnish a detailed schedule framework, in hard copy and disk, to the Contractors.

a. Contractors shall utilize the detailed schedule framework to prepare their Construction Progress Schedule for their specific scope of work.

b. The Schedule Manager will schedule and conduct a minimum of two Schedule Sequence Review Meetings with mandatory attendance by all Contractors to meet the Construction Progress Schedule submission requirement within 60 calendar days after the Notice to Proceed is issued.

B. Contractors shall provide Construction Progress Schedule requirements specified herein to the Schedule Manager so that they can prepare a fully coordinated Construction Progress Schedule.

1. If the Project utilizes the Stipulated Sum Multiple-Prime Contract model, the Lead Contractor shall include an Allowance for Schedule Consultant Services in their bid and procure Schedule Consultant services to meet these requirements, in accordance with the General Conditions.

2. If the Project utilizes the Stipulated Sum Single-Prime Contract model, the Contractor shall include in their bid and provide scheduling services to meet these requirements, in accordance with the General Conditions.

C. The Schedule Manager will submit the Construction Progress Schedule through the Lead Contractor, if applicable, with signatures indicating approval by all contractors to the A/E.

1. If acceptable, the A/E and Contracting Authority will accept the schedule.

2. If not acceptable, the schedule will be returned to the Schedule Manager for revision. The revised schedule, with approval signatures for all Contractors, shall be resubmitted.

PART 2 PRODUCTS

2.01 SCHEDULE SOFTWARE

A. The computer software utilized by the Schedule Manager to produce the project schedule will be Primavera Products as marketed by Primavera Systems, Inc. or a substitution accepted by the Contracting Authority.

PART 3 EXECUTION

3.01 CRITICAL PATH METHOD

A. The Critical Path Method (CPM) of network calculations will be used to generate the schedule. The Schedule Manager shall provide the schedule in either the Precedence Diagram Method (PDM) or the Arrow Diagram Method (ADM).

3.02 LEVEL OF DETAIL REQUIRED

A. With the exception of the preliminary schedule submission, the Construction Progress Schedule shall include an appropriate level of detail. Failure of the Schedule Manager to develop or update the schedule or provide resource information will result in the disapproval of the schedule.

B. Activity Durations:

1. Submit the following data to support the schedule calendar as it relates to durations. Failure of the Schedule Manager to include this data will delay the review of the submittal until the A/E receives the missing data.

a. The proposed number of working days per week.

b. The holidays to be observed during the life of the contract (by day, month and year).

c. The planned number of shifts per day.

d. The number of hours per shift.

e. Break up the work into activities of a duration no longer than 20 work days each, except as to non-construction activities (e.g., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities for which the Owner may approve a longer duration.

C. Procurement Activities:

1. Prepare the schedule in chronological order of submittals. Show specification section of the submittal, name of contractor and generic description of work covered. Include activities to cover the complete procurement process to include but not limited to: submittal, review, approval, resubmittal, procurement, fabrication, delivery, permits, and similar pre-construction work.

D. Manpower:

1. Activities shall have an estimate of the average number of workers per day that are expected to be used during the execution of the activity.

2. Identification of manpower, material, or equipment restrictions, as well as any activity requiring unusual shift work, such as two shifts per day, six day work week, specified overtime, or work at times other than regular days or hours shall clearly be identified in the Project Schedule.
3. Critical or near Critical Paths resulting from the use of manpower or equipment restraints shall be kept to a minimum. Near Critical Paths are defined as paths having 10 workdays or less of total float.

E. Cost:

1. All activities shall be cost loaded in a logical manner tying to each Contractor's Schedule of Values.

F. Responsibility:

1. All activities shall be identified in the Construction Progress Schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the Contracting Firm, the Subcontracting Firm, Contractor Workforce, or Agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

G. Work Areas:

1. Arrange the schedule to show each major area of construction for each major category or unit of work.
2. All activities shall be identified in the Construction Progress Schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

H. Change Order or Claim Number:

1. Any activity that is added or changed by a change order or used to justify any claimed time, shall be identified by change order code that changed the activity. Activities may not belong to more than one change order.

I. Milestones:

1. Milestone dates are defined in calendar days following the date set forth in the Notice to Proceed and are required to be met by all Contractors. Time is of the essence for the completion of Milestones and for the Contract Completion date.
2. The following Milestone dates are defined in calendar day from the Notice to Proceed, and shall be adhered to by each Contractor.
    a. Milestone M1 - < describe >
    b. Milestone M2 - < describe >
    c. Milestone M3 - < describe >

J. Adverse Weather

1. Definitions
    a. Adverse Weather Day: A day when the magnitude of a weather parameter (precipitation or temperature) is such that it creates conditions that inhibit the ability of the contractor to work productively on critical construction activities.
    b. Expected Adverse Weather Days: The number of adverse weather days expected to occur on a monthly basis and defined for two different construction types (1. Grading and 2. Surfacing and Structures).
    c. Unexpected Adverse Weather Days: The number of adverse days that exceed the expected number of adverse weather days determined on a monthly basis. Also number of days with lightning and/or high winds that inhibit the ability of the contractor to work productively on critical construction activities as corroborated by the A/E.

d. Actual Adverse Weather days: The actual number of adverse weather days that occur during a single month.

e. Precipitation: Rain, snow, or hail where 1” of rain equals 12” of snow.

f. Calendar Day is based on all available days including weekends and holidays.

g. Working Day is based on a five-day work week and exclude weekends and holidays.

2. Methodology

a. Adverse Weather Days Criteria

1) A single precipitation threshold of greater than 7.62 mm (0.30 in) determines an adverse weather day for Type 1 and Type 2 construction.

2) A single precipitation threshold of greater than 19.05 mm (0.75 in) the previous day determines an adverse weather day/additional non-working day for Type 1 construction only.

3) A single precipitation threshold of greater than 7.62 mm (0.30 inch) reached before shut down determines an adverse weather day for Type 1 and Type 2 construction.

4) A single daily maximum temperature threshold of less than 0 degrees C (32 degrees F) determines an adverse weather day for Types 1 & 2 construction.

5) A combination of daily maximum temperature less than 0 degrees C (32 degrees F) and precipitation greater than 7.62 mm (0.30 inch) determines a single adverse weather day.

b. Expected Adverse Weather Days

1) Calculate the average number of expected adverse weather calendar days per month based on 5 years of data from [Select local weather station] posted by The Weather Underground Inc. (wunderground.com) for each construction type.

2) Calculate the average number of expected adverse work days per month by multiplying the average number of expected adverse weather calendar days per month by 5/7.

3.03 SCHEDULED PROJECT COMPLETION

A. Project Start Date:

1. The Construction Progress Schedule may start no earlier than the date that the Notice to Proceed (NTP) was issued. The Schedule Manager shall include as the first activity in the Construction Progress Schedule an activity called “Notice to Proceed.” The “Notice to Proceed” activity shall have: an “ES (early start) constraint, a constraint date equal to the date that the NTP was issued, and a zero day duration.

B. Constraint of Last Activity:

1. Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the Critical Path. The Schedule Manager shall include as the last activity in the Project Schedule an activity called “Contract Complete”. The “Contract Complete” activity shall have a: “LF” (late finish) constraint, a constraint date equal to the completion date equal to the date identified in the NTP for the project, and a zero day duration.

3.04 INTERIM COMPLETION DATES (MILESTONES)

A. Contractually specified interim completion dates (Milestone dates) shall also be constrained to show negative float if early finish date of the last activity in that phase falls after the interim completion date.

3.05 HAMMOCK ACTIVITIES FOR CONTRACTS

A. The Schedule Manager shall include a hammock type activity for each Contractor. The Contractor activity shall be logically tied to the earliest and latest activities in the Contractor's Scope of Work. Hammock activities shall be identified within "HA" at the beginning of the Activity ID.

3.06 DEFAULT PROGRESS DATA DISALLOWED

A. Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in the CPM Scheduling Software Systems. Actual Start and Finish dates and Remaining Durations on the CPM Schedule shall match those dates provided from Contractor Daily Reports for every in progress or completed activity and insure that the data contained on the Daily Reports is the sole basis for schedule updating. Failure to comply may result in the disapproval of schedule.

3.07 OUT OF SEQUENCE PROGRESS

A. Activities that have posted progress without predecessors being completed (Out of Sequence Progress) shall be allowed only by the case by case approval of the Owner. The A/E may direct that changes in schedule logic be made to correct any or all Out of Sequence Work.

3.08 NEGATIVE LAG(S)

A. Lag durations contained in the schedule shall not have a negative value.

3.09 DEFINITION OF, AND CONDITIONS RELATING TO FLOAT

A. Float is defined as the amount of time between the early start date and the late start date, or the early finish date and the late finish date, of any activity in the schedule. Total float is defined as the amount of time any given activity or path of activities may be delayed before it will affect the project completion time.

B. Float is not time for the exclusive use or benefit of the Contractor, and shall be used in the best interest of completing the project on time.

C. Extensions of time for performance required under the General Conditions pertaining to equitable time adjustment will be granted only to the extent that the equitable time adjustment exceeds total float in the activity or path of activities affected at the time approval was issued for the change.

D. Use of float suppression techniques such as preferential sequences, special lead/lag logic restraints, extended activity times, or imposed dates, other than as required by the Contract, shall be cause for rejection of the Construction Progress Schedule and any revisions or updates.

3.10 PRELIMINARY CONSTRUCTION PROGRESS SCHEDULE

A. The preliminary Construction Progress Schedule, defining the Contractor's planned operations for the first 120 calendar days shall be submitted for approval within 30 calendar days after Notice to Proceed is issued. The approved preliminary schedule shall be used for payment purposes and the basis for measuring Contractor progress not to exceed 120 days after Notice to Proceed is issued.

1. Paper copies shall be provided in color on minimum 11 inch by 17 inch paper.

B. Schedule Review and Comments

1. Comments made by the A/E on the Construction Progress Schedule during review shall not relieve the Contractors from compliance with the requirements of the Contract Documents.

2. Following the Contractor's receipt of the A/E's review comments, the Contractors shall correct the schedule to identify missing activities and relationships relevant to the Scope of Work. No time extensions will be granted to complete activities not initially included in the Contractor's Construction Progress Schedule.

3. To the extent that there are any conflicts between the approved Construction Progress Schedule and the requirements of the Contract Documents, the Contract Documents shall govern.

C. Resubmittal of Construction Progress Schedule

1. Should the A/E reject the Construction Progress Schedule, the Schedule Manager shall comply with the A/E's direction and resubmit the Construction Progress Schedule and all associated submittals within 7 calendar days.

3.11 APPROVED CONSTRUCTION PROGRESS SCHEDULE

A. The Construction Progress Schedule approved by the Contractors shall be submitted for acceptance within 90 calendar days after the Notice to Proceed is issued. It shall provide a reasonable sequence of activities which represent work through the entire project and a reasonable level of detail.

1. Paper copies shall be provided in color on minimum 11 inch by 17 inch paper.

B. The approved Construction Progress Schedule shall show the sequence and interdependence of activities required for complete performance of the work, beginning with Contractor's receipt of the Notice to Proceed and concluding with the date of Final Completion of the Contract. The Construction Progress Schedule shall show all activities in workdays, with allowance for holidays and the effects of normal weather conditions on outside work.

C. The approved Construction Progress Schedule shall comply with all limits imposed by the Scope of Work, with all contractually specified intermediate milestones and completion dates, and with all constraints, restraints, or sequences included in the Contract.

D. The Construction Progress Schedule network (graphic presentations) and computer tabulations, the Resource Loading curve and the Contractor's signatures shall be submitted to the A/E for acceptance. Additionally, the Schedule Manager shall submit two copies of the data, containing the resource loaded Construction Progress Schedule.

E. The following computer generated reports in hard copy shall be required as part of the Preliminary and Approved Construction Progress Schedule submittals:

1. Activity ID Report
2. Total Float/Early Start Report
3. Logic Report
4. Resource Report
5. Coding Dictionary

F. The schedule network (graphic presentation) shall include:

1. Activity ID
2. Activity Description
3. Original Durations
4. Remaining Durations
5. Early Start and Finish Dates
6. Baseline Start and Finish Dates
7. Total Float
8. Percent Complete

G. The schedule shall be sorted by Early Start and Total Float and shall show both the Early and Target Schedule.

H. The Owner shall accept or reject, in writing, the Construction Progress Schedule and the associated submittals. If the Construction Progress Schedule is rejected, the Owner shall provide comments in writing to the Schedule Manager stating the reasons why the submission was not accepted.

3.12 Periodic Schedule Updates

A. The following computer generated reports in hard copy and on computer diskettes shall be required as a part of the monthly update thereof as a condition precedent to the receipt of progress payments under the Contract.

B. The Contractor's monthly narrative report is to include:

1. Activities started in the month (with actual start dates).
2. Activities completed during the month (with actual start and completion dates).
3. Activities in progress (with estimated remaining durations).
4. Activities scheduled to start in the next month (with estimated start dates).
5. A list of approved logic changes.
6. A list of proposed logic changes, new activities, and deleted activities.
7. Recommendations for adjusting the Construction Progress Schedule to meet milestone completion and Contract completion dates (include why the schedule needs adjusted, e.g., change order, weather, contractor resources, etc.).
    a. Construction Contract Adjustment for Unexpected Adverse Weather
        1) Contract adjustment is justified when the number of actual adverse weather work days exceeds the expected number of adverse weather work days over the life of the project.
        2) The number of actual adverse weather work days and related construction task(s) are to be reported on a monthly basis at the last Progress Meeting of the month as a condition of Payment Application approval.
        3) The A/E is to verify with documentation the actual adverse weather work days reported by each Contractor.
        4) The calculation of the difference between the actual adverse working weather days and expected adverse weather working days is to be reported at the first Progress Meeting of the month by the A/E.
8. Attach copies of the Contractors' weekly schedule reports.

C. The Contractors graphic presentation of the schedule is to include:

1. Activity ID.
2. Activity Description.
3. Original Durations.
4. Remaining Durations.
5. Early Start and Finish Dates.
6. Baseline Start and Finish Dates.
7. Total Float.
8. Percent Complete.
9. The schedule shall be sorted by Early Start and Total Float and should show both the early schedule and the target schedule.

D. Electronic data supporting the update shall be provided.

E. Computer generated reports are to include:

1. Activity ID Report.
2. Total Float/Early Start Report.
3. Logic Report.
4. In Progress or Planned to Start Report.
5. In Progress or Planned to Finish Report.
6. Resource Report.

3.13 TWO-WEEK LOOK AHEAD SCHEDULE SUBMISSION

A. The Schedule Manager shall provide a two-week Look Ahead Schedule for review at the Progress Meeting that occurs closest to the 15th of each month. The Look Ahead Schedule will be based on the most recent monthly update and will show only those activities that are scheduled to begin or are in progress during the week before and for two weeks after the 15th of the current month. The two-week Look Ahead Schedule reports will contain the following information for each activity and will be required from the Contractor throughout the duration of the project unless directed otherwise by the A/E.

1. Activity I.D.
2. Activity Description
3. Original Duration
4. Remaining Duration
5. Early Start Date
6. Early Finish Date
7. Percent Complete
8. Total Float
9. Bar Graph Presentation

3.14 STANDARD ACTIVITY CODING DICTIONARY

A. The Schedule Manager shall submit, with the Construction Progress Schedule, a coding scheme that shall be used throughout the project for all activity codes contained in the schedule. The coding scheme submitted shall list the values for each activity code category and translate those values into project specific designations. For example, A Responsibility Code Value, “ELE”, may be identified as “Electrical Subcontractor”. Activity code values shall represent the same information throughout the duration of the contract. Once approved with the Preliminary (first 90 calendar day) Project Schedule Submission, changes to the activity coding scheme shall be approved by the A/E.

3.15 DATA

A. The preliminary, approved, and update Construction Progress Schedules shall be provided in the form of electronic files.

B. File Medium:

1. Submit data on media acceptable to the Contracting Authority.

C. Disk Label:

1. The Schedule Manager shall affix a permanent exterior label to each disk submitted. The label shall indicate the type of schedule (preliminary, target, update or change), full contract number, project name, project location, data date, name and telephone number of person responsible for the schedule, and file name.

D. File Name:

1. The Schedule Manager shall insure that each file submitted has a name related to the schedule data date, project name, or contract number. The Schedule Manager shall develop a naming

convention that will insure that the names of all the files submitted are unique. The Schedule Manager shall submit the file naming convention to the A/E.

E. OAKS Capital Improvements

1. If the Project is administered using OAKS CI, the Construction Progress Schedule and associated data shall be submitted to the A/E through the Schedule Approvals business process.

3.16 APPROVED CHANGES VERIFICATION

A. Only Construction Progress Schedule changes that have been previously approved by the A/E shall be included in the schedule submission. The narrative report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

B. The Contractor shall prosecute the work in accordance with the approved Construction Progress Schedule. Out of sequence construction, defined as a change from the Construction Progress Schedule in the Contractor's actual operation requires prior approval from the A/E.

C. Upon the approval of a change order or the issuance of a unilateral change order by the Contracting Authority the agreed upon change order activities, activity durations, logic and impacts shall be reflected in the next schedule submittal by the Schedule Manager.

D. No change to the approved activities, original activity durations, logic, interdependencies, milestones, planned sequence of operations, or resource loading of the Construction Progress Schedule shall be made without prior approval from the A/E. If the Contractor desires to make a change to the approved Construction Progress Schedule, the Contractor shall request permission from the A/E in writing, stating the reasons for the change as well as the specifics, such as the proposed changes in activities, original activity durations, logic, interdependencies, milestones, planned sequence of operations, or resource loading of the baseline Construction Progress Schedule. The A/E shall respond within 14 calendar days after the receipt of the Contractor's request.

E. If the A/E considers the Construction Progress Schedule change requested by the Contractor to be a major change, it may require the Contractor to revise and submit for approval, without additional cost to the Owner, all of the affected portions of the network diagrams, and any schedule reports, or construction equipment reports deemed necessary to show the probable effect on the entire project. The proposed network revision and required reports shall be submitted to the A/E within seven calendar days after the A/E notifies the Contractor that the requested revision is a major change. Only upon the approval of the requested change by the A/E may it be reflected in the next Construction Progress Schedule update submitted by the Contractor.

F. A change will be considered of a major nature if the time estimated for an activity or sequence of activities is varied from the original plan to the degree that there is reasonable doubt that the Contract Completion date or milestones will be met, or if the change impacts the work of other Contractors at the job site. Changes to activities having adequate float may be considered as minor changes, except that an accumulation of minor changes may be considered a major change when such changes affect the Contract Completion date or milestones.

3.17 SCHEDULE REPORTS

A. The format of each activity for the schedule reports listed below shall contain:

1. Activity ID Number(s).
2. Activity Description.
3. Original Duration.
4. Remaining Duration.
5. Early Start Date.
6. Early Finish Date.
7. Baseline Start Date.
8. Baseline Finish Date.

9. Total Float.

10. Actual Start and Actual Finish dates shall be printed for those activities in progress or completed.

B. Activity ID Report: A list of all activities sorted according to Activity ID number and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.

C. Logic Report: A list of preceding and succeeding activities for every activity in ascending order by activity number and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.

D. Total Float Report: A list of all activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates.

3.18 NETWORK DIAGRAM (GRAPHIC PRESENTATION)

A. The network diagram is required on the preliminary, baseline and monthly schedule submissions. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The A/E will use, but is not limited to, the following conditions to review compliance with this paragraph:

1. Continuous Flow: Diagrams shall show a continuous flow from left to right. The Activity ID, description, original duration, remaining duration, early start and finish dates, target start and finish dates, total float and percent completed shall be shown on the diagram.

2. Project Milestone Dates: Dates shall be shown on the diagram from start of any project, any contract required interim completion dates, and contract completion dates.

3. Critical Path(s): The Critical Path(s) shall be clearly shown.

4. Banding: Activities shall be grouped to assist in the clear understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

END OF SECTION

SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Periodic construction photographs.
2. Daily construction photographs as required to accompany daily field reports.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting photographic documentation.

1.3 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three (3) days of taking photographs.

1. Digital Camera: Minimum sensor resolution of eight (8) megapixels.
2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
3. Identification: Provide the following information with each image description in file metadata tag:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect.
d. Name of Contractor.
e. Date photograph was taken.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
g. Unique sequential identifier keyed to accompanying key plan.

1.4 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of eight (8) megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.
2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect and Construction Manager.

C. Provide daily construction photos to show work as listed on the daily field reports.

D. Periodic Construction Photographs: Take 12 photographs daily coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

END OF SECTION 01 32 33

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 01 31 00 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 01 32 33 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
5. Section 01 40 00 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
6. Section 01 77 00 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
7. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
8. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
9. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled date of fabrication.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.
10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.
15. Remarks.
16. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.

a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams that show factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

a. Project name and submittal number.
b. Generic description of Sample.

c. Product name and name of manufacturer.
d. Sample source.
e. Number and title of applicable Specification Section.
f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit three sets of Samples. Architect will retain one Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.

e. Description of product.
f. Test procedures and results.
g. Limitations of use.

1.7 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.

1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect will discard submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.

1. Mockups are used for one or more of the following:

a. Verify selections made under Sample submittals.
b. Demonstrate aesthetic effects.
c. Demonstrate the qualities of products and workmanship.
d. Demonstrate successful installation of interfaces between components and systems.
e. Perform preconstruction testing to determine system performance.

2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) in accordance with 29 CFR 1910.7, by a testing agency accredited in accordance with NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.3 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

F. Reports: Prepare and submit certified written reports and documents as specified.

G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.

B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.8 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.

1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor's Responsibilities:

    a. Provide test specimens representative of proposed products and construction.
    b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    d. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

L. Specialty Mockups: See Section 01 43 39 "Mockups" for additional construction requirements for integrated exterior mockups.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.

    a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan]. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.

3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and authorities' having jurisdiction reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms, including "requested," "authorized," "selected," "required," and "permitted," have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms, including "shown," "noted," "scheduled," and "specified," have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations, List: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list.The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; (see FGIA).
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; www.concrete.org.
9. ACP - American Clean Power; (Formerly: American Wind Energy Association); www.cleanpower.org.
10. ACPA - American Concrete Pipe Association; www.concretepipe.org.
11. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
12. AF&PA - American Forest & Paper Association; www.afandpa.org.
13. AGA - American Gas Association; www.aga.org.
14. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
15. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
16. AI - Asphalt Institute; www.asphaltinstitute.org.
17. AIA - American Institute of Architects (The); www.aia.org.
18. AISC - American Institute of Steel Construction; www.aisc.org.
19. AISI - American Iron and Steel Institute; www.steel.org.
20. AITC - American Institute of Timber Construction; (see PLIB).
21. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
22. AMPP - Association for Materials Protection and Performance; www.ampp.org.
23. ANSI - American National Standards Institute; www.ansi.org.
24. AOSA/SCST - Association of Official Seed Analysts (The)/Society of Commercial Seed Technologists (The); www.analyzeseeds.com.
25. APA - APA - The Engineered Wood Association; www.apawood.org.
26. APA - Architectural Precast Association; www.archprecast.org.
27. API - American Petroleum Institute; www.api.org.
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASA - Acoustical Society of America; www.acousticalsociety.org.
30. ASCE - American Society of Civil Engineers; www.asce.org.
31. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (see ASCE).
32. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
33. ASME - ASME International; American Society of Mechanical Engineers (The); www.asme.org.
34. ASSE - ASSE International; (American Society of Sanitary Engineering); www.asse-plumbing.org.
35. ASSP - American Society of Safety Professionals; www.assp.org.
36. ASTM - ASTM International; www.astm.org.
37. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
38. AVIXA - Audiovisual and Integrated Experience Association; www.avixa.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.

40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWPA - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - Business and Institutional Furniture Manufacturer's Association; www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BWF - Badminton World Federation; www.bwfbadminton.com.
50. CARB - California Air Resources Board; www.arb.ca.gov.
51. CDA - Copper Development Association Inc.; www.copper.org.
52. CE - Conformite Europeenne (European Commission); www.ec.europa.eu/growth/single-market/ce-marking.
53. CEA - Canadian Electricity Association; www.electricity.ca.
54. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
55. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
56. CGA - Compressed Gas Association; www.cganet.com.
57. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
58. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
59. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
60. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
61. CPA - Composite Panel Association; www.compositepanel.org.
62. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
63. CRRC - Cool Roof Rating Council; www.coolroofs.org.
64. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
65. CSA - CSA Group; www.csagroup.org.
66. CSI - Cast Stone Institute; www.caststone.org.
67. CSI - Construction Specifications Institute (The); www.csiresources.org.
68. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
69. CTA - Consumer Technology Association; www.cta.tech.
70. CTI - Cooling Technology Institute; www.coolingtechnology.org.
71. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
72. DHA - Decorative Hardwoods Association; www.decorativehardwoods.org.
73. DHI - Door and Hardware Institute; www.dhi.org.
74. ECIA - Electronic Components Industry Association; www.ecianow.org.
75. EIMA - EIFS Industry Members Association; www.eima.com.
76. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
77. EOS/ESD - EOS/ESD Association, Inc.; Electrostatic Discharge Association; www.esda.org.
78. ESTA - Entertainment Services and Technology Association; www.esta.org.
79. EVO - Efficiency Valuation Organization; www.evo-world.org.
80. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
81. FGIA - Fenestration and Glazing Industry Alliance; https://fgiaonline.org.
82. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
83. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
84. FM Approvals - FM Approvals LLC; www.fmapprovals.com.
85. FM Global - FM Global; www.fmglobal.com.
86. FRSA - Florida Roofing and Sheet Metal Contractors Association, Inc.; www.floridaroof.com.
87. FSA - Fluid Sealing Association; www.fluidsealing.com.
88. FSC - Forest Stewardship Council U.S.; www.fscus.org.
89. GA - Gypsum Association; www.gypsum.org.
90. GS - Green Seal; www.greenseal.org.

91. HI - Hydraulic Institute; www.pumps.org.
92. HMMA - Hollow Metal Manufacturers Association; (see NAAMM).
93. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
94. IAS - International Accreditation Service; www.iasonline.org.
95. ICC - International Code Council; www.iccsafe.org.
96. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
97. ICPA - International Cast Polymer Association (The); www.theicpa.com.
98. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
99. IEC - International Electrotechnical Commission; www.iec.ch.
100. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
101. IES - Illuminating Engineering Society; www.ies.org.
102. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
103. IGMA - Insulating Glass Manufacturers Alliance; (see FGIA).
104. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
105. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
106. Intertek - Intertek Group; www.intertek.com.
107. ISA - International Society of Automation (The); www.isa.org.
108. ISFA - International Surface Fabricators Association; www.isfanow.org.
109. ISO - International Organization for Standardization; www.iso.org.
110. ITU - International Telecommunication Union; www.itu.int.
111. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
112. LPI - Lightning Protection Institute; www.lightning.org.
113. MBMA - Metal Building Manufacturers Association; www.mbma.com.
114. MCA - Metal Construction Association; www.metalconstruction.org.
115. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
116. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
117. MHI - Material Handling Industry; www.mhi.org.
118. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
119. MPI - Master Painters Institute; www.paintinfo.com.
120. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry, Inc.; www.msshq.org.
121. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
122. NACE - NACE International; (National Association of Corrosion Engineers International); (see AMPP).
123. NADCA - National Air Duct Cleaners Association; www.nadca.com.
124. NAIMA - North American Insulation Manufacturers Association; www.insulationinstitute.org.
125. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
126. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
127. NBI - New Buildings Institute; www.newbuildings.org.
128. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
129. NCMA - National Concrete Masonry Association; www.ncma.org.
130. NEBB - National Environmental Balancing Bureau; www.nebb.org.
131. NECA - National Electrical Contractors Association; www.necanet.org.
132. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
133. NEMA - National Electrical Manufacturers Association; www.nema.org.
134. NETA - InterNational Electrical Testing Association; www.netaworld.org.
135. NFHS - National Federation of State High School Associations; www.nfhs.org.
136. NFPA - National Fire Protection Association; www.nfpa.org.
137. NFPA - NFPA International; (see NFPA).
138. NFRC - National Fenestration Rating Council; www.nfrc.org.
139. NGA - National Glass Association; www.glass.org.
140. NHLA - National Hardwood Lumber Association; www.nhla.com.
141. NLGA - National Lumber Grades Authority; www.nlga.org.
142. NOFMA - National Oak Flooring Manufacturers Association; (see NWFA).
143. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
144. NRCA - National Roofing Contractors Association; www.nrca.net.

145. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
146. NSF - NSF International; www.nsf.org.
147. NSI - Natural Stone Institute; www.naturalstoneinstitute.org.
148. NSPE - National Society of Professional Engineers; www.nspe.org.
149. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
150. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
151. NWFA - National Wood Flooring Association; www.nwfa.org.
152. NWRA - National Waste & Recycling Association; www.wasterecycling.org.
153. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
154. PDI - Plumbing & Drainage Institute; www.pdionline.org.
155. PLASA - PLASA; www.plasa.org.
156. PLIB - Pacific Lumber Inspection Bureau; www.plib.org.
157. PVCPA - Uni-Bell PVC Pipe Association; www.uni-bell.org.
158. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
159. RFCI - Resilient Floor Covering Institute; www.rfci.com.
160. RIS - Redwood Inspection Service; (see WWPA).
161. SAE - SAE International; www.sae.org.
162. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
163. SDI - Steel Deck Institute; www.sdi.org.
164. SDI - Steel Door Institute; www.steeldoor.org.
165. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
166. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (see ASCE).
167. SIA - Security Industry Association; www.securityindustry.org.
168. SJI - Steel Joist Institute; www.steeljoist.org.
169. SMA - Screen Manufacturers Association; www.smainfo.org.
170. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
171. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
172. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
173. SPIB - Southern Pine Inspection Bureau; www.spib.org.
174. SPRI - Single Ply Roofing Industry; www.spri.org.
175. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
176. SSINA - Specialty Steel Industry of North America; www.ssina.com.
177. SSPC - SSPC: The Society for Protective Coatings; (see AMPP).
178. STI/SPFA - Steel Tank Institute/Steel Plate Fabricators Association; www.steeltank.com.
179. SWI - Steel Window Institute; www.steelwindows.com.
180. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
181. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
182. TCNA - Tile Council of North America, Inc.; www.tcnatile.com.
183. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.kbcdco.tema.org.
184. TIA - Telecommunications Industry Association (The); www.tiaonline.org.
185. TMS - The Masonry Society; www.masonrysociety.org.
186. TPI - Truss Plate Institute; www.tpinst.org.
187. TPI - Turfgrass Producers International; www.turfgrasssod.org.
188. TRI - Tile Roofing Industry Alliance; www.tileroofing.org.
189. UL - Underwriters Laboratories Inc.; www.ul.org.
190. UL LLC - UL LLC; www.ul.com.
191. USAV - USA Volleyball; www.usavolleyball.org.
192. USGBC - U.S. Green Building Council; www.usgbc.org.
193. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
194. WA - Wallcoverings Association; www.wallcoverings.org.
195. WCLIB - West Coast Lumber Inspection Bureau; (see PLIB).
196. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
197. WDMA - Window & Door Manufacturers Association; www.wdma.com.
198. WI - Woodwork Institute; www.woodworkinstitute.com.
199. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.

200. WWPA - Western Wood Products Association; www.wwpa.org.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. CPSC - U.S. Consumer Product Safety Commission; www.cpsc.gov.
2. DOC - U.S. Department of Commerce; www.commerce.gov.
3. DOD - U.S. Department of Defense; www.defense.gov.
4. DOE - U.S. Department of Energy; www.energy.gov.
5. DOJ - U.S. Department of Justice; www.ojp.usdoj.gov
6. DOS - U.S. Department of State; www.state.gov.
7. EPA - United States Environmental Protection Agency; www.epa.gov.
8. FAA - Federal Aviation Administration; www.faa.gov.
9. GPO - U.S. Government Publishing Office; www.gpo.gov.
10. GSA - U.S. General Services Administration; www.gsa.gov.
11. HUD - U.S. Department of Housing and Urban Development; www.hud.gov.
12. LBNL - Lawrence Berkeley National Laboratory; Energy Technologies Area; www.lbl.gov/.
13. NIST - National Institute of Standards and Technology; www.nist.gov.
14. OSHA - Occupational Safety & Health Administration; www.osha.gov.
15. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
16. USACE - U.S. Army Corps of Engineers; www.usace.army.mil.
17. USDA - U.S. Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
18. USDA - U.S. Department of Agriculture; Rural Utilities Service; www.usda.gov.
19. USP - U.S. Pharmacopeial Convention; www.usp.org.
20. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from U.S. Government Publishing Office; www.govinfo.gov.
2. DOD - U.S. Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
3. DSCC - Defense Supply Center Columbus; (see FS).
4. FED-STD - Federal Standard; (see FS).
5. FS - Federal Specification; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from U.S. General Services Administration; www.gsa.gov.

c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.

6. MILSPEC - Military Specification and Standards; (see DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (see USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. BEARHFTI; California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; (see BHGS).
2. BHGS; State of California Bureau of Household Goods and Services; (Formerly: California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation); www.bhgs.dca.ca.gov.
3. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.oal.ca.gov/publications/ccr/.
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; https://tfsweb.tamu.edu/.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

2. Install project identification and other signs in locations approved by Owner to inform the public and persons seeking entrance to Project.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.

C. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

D. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations. Retain "Sewer, Water, and Electric Power Service" Paragraph below if multiple contracts are required. If needed, insert use-charge requirements for other utilities needed for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

D. Dust- and HVAC-Control Plan: As required to perform the work and coordinate with DEPARTMENT OF YOUTH SERVICES's ongoing operation, submit coordination drawing and narrative, as required, that indicate the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
1. Waste-handling procedures.
2. Other dust-control measures.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

B. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches (914 by 1524 mm).

2.2 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with regulations and health codes, and with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

D. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

3.2 SUPPORT FACILITIES INSTALLATION

F. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.

2. Remove snow and ice as required to minimize accumulations.

H. Waste Disposal Facilities: Comply with requirements specified in Section 01 7419 "Construction Waste Management and Disposal."

I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Collect waste daily and, when containers are full, legally dispose of waste off-site. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."

J. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

1. Do not load elevators beyond their rated weight capacity.
2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

K. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide temporary environmental protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 01 1000 "Summary."

C. Tree and Plant Protection: Protect existing landscaping and restore any areas damaged during construction to original condition prior to start of project.

D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

E. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

G. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

H. Temporary Partitions: Provide floor-to-ceiling dustproof partitions and/or other approved measures to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.
   1. Protect air-handling equipment.
   2. Provide walk-off mats at each entrance through temporary partition.

I. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

   1. Prohibit smoking in or on London CI property.
   2. Supervise heat-treating operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

J. Furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

3.4 OPERATION TERMINATION AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Termination and Removal: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service. Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

   1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape

development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
2. Section 01 42 00 "References" for applicable industry standards for products specified.
3. Section 01 77 00 "Closeout Procedures" for submitting warranties.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published

attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 33 00 "Submittal Procedures."

F. Substitution: Refer to Section 01 25 00 "Substitution Procedures" for definition and limitations on substitutions.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Resolution of Compatibility Disputes between Multiple Contractors:

a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

a. Name of product and manufacturer.
b. Model and serial number.
c. Capacity.
d. Speed.
e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.5 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."

2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

   a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.

   a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
   b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

   a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.

   a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
   b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

   a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items. Premium items include color matching.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 33 00 "Submittal Procedures."

1. Form of Approval of Submittal: As specified in Section 01 33 00 "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Installation of the Work.
3. Cutting and patching.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

B. Related Requirements:

1. Section 01 10 00 "Summary" for limits on use of Project site.
2. Section 01 33 00 "Submittal Procedures" for submitting surveys.
3. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and

support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Mechanical systems piping and ducts.
    f. Control systems.
    g. Communication systems.
    h. Fire-detection and -alarm systems.
    i. Conveying systems.
    j. Electrical wiring systems.
    k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Sprayed fire-resistive material.
    d. Equipment supports.
    e. Piping, ductwork, vessels, and equipment.
    f. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

D. The Contractor shall review means, methods, techniques, sequences and procedures indicated in the Contract Documents either directly or by reference to standards or manufacturer’s instructions; and advise the Contracting Officer, or their designated representative, (1) if the specified procedure deviates from good construction practice, (2) if following the procedure will affect warranties including the Contractor’s general warranty, or (3) of objections the Contractor may have to the procedure and propose alternative procedures the Contractor will warrant.

E. Examine substrates and conditions for compliance with manufacturer's written requirements including, but not limited to, surfaces that are sound, level, plumb, smooth, clean, and free of deleterious substances; substrates within installation tolerances; and application conditions within environmental limits. Proceed with installation only after unsatisfactory conditions have been corrected.

F. Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to property survey and existing benchmarks.

G. Do not scale the Drawings. Follow indicated dimensions. In case of discrepancy in the figures, bring the matter to the attention of the the Contracting Officer, or their designated representative, for interpretation before proceeding with the Work. Failure to follow this procedure shall be at the Contractor's own risk, and the Contracting Officer, or their designated representative, interpretation shall be final.

H. Take field measurements as required to fit the Work properly. Where fabricated products are to be fitted to other construction, verify dimensions by field measurement before fabrication and, when possible, allow for fitting and trimming during installation.

I. Unless specifically identified, the terms "repair, replace, repair or replace" shall mean repair in a workmanlike manner, and "install or furnish and install", shall be understood to mean "Furnish all material required and Install".

J. Installation General: Comply with manufacturer's written instructions for installation. Anchor each product securely in place, accurately located and aligned with other portions of the Work. Clean exposed surfaces and protect from damage.

1. All work shall be executed only by artisans and mechanics qualified through experience in their respective trades.

K. Maintenance: The following site maintenance shall be performed for the entire duration of the construction/renovation process.

1. Clean Project site and work areas daily, including common areas.

2. The cutting of grass and proper disposal of clippings, to be performed on a regular weekly basis and/or as dictated by need..

3. The removal of snow from public access walkways and adjacent site walkways.

L. Complete the cleaning operations before requesting inspection for certification of Substantial Completion:

PART 2 - PRODUCTS

2.1 MATERIALS

A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence

and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 3100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

C. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Do not cut structural members or operational elements without prior written approval of the Contracting Officer, or their designated representative.

F. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

2. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.

G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

H. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 1000 "Summary."

I. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

J. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If

possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

K. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

L. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 4000 "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final Completion procedures.
3. List of incomplete items.
4. Submittal of Project warranties.
5. Final cleaning.

B. Related Requirements:

1. Section 01 29 00 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
2. Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
3. Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
4. Section 01 79 00 "Demonstration and Training" for requirements to train Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's observation, to determine if the Work is substantially complete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting observation for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.

5. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting observation for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting observation and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Observation: Submit a written request for observation to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final observation and tests. On receipt of request, Architect will either proceed with observation or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after observation or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reobservation when the Work identified in previous observations as incomplete is completed or corrected.
2. Results of completed observation will form the basis of requirements for Final Completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final observation for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 01 29 00 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion observation list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit Final Completion photographic documentation.

B. Observation: Submit a written request for final observation to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final observation and tests. On receipt of request, Architect will either proceed with observation or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after observation or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reobservation when the Work identified in previous observations as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.

e. Page number.

4. Submit list of incomplete items in the following format:

a. MS Excel Electronic File: Architect will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit by email to Architect.

E. Warranties in Paper Form:

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

F. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting observation for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
i. Vacuum and mop concrete.
j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's instructions if visible soil or stains remain.
k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
l. Remove labels that are not permanent.
m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on observation.
q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
r. Clean strainers.
s. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

3.2 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 01 73 00 "Execution" before requesting observation for determination of Substantial Completion.

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:
1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.

b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.

4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.

4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence

and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 01 78 39 "Project Record Documents."

G. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS (AS-BUILTS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:

1. Section 01 73 00 "Execution" for final property survey.
2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record prints.
2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit PDF electronic files of scanned Record Prints and three set(s) of file prints.
2) Print each drawing, whether or not changes and additional information were recorded.
3) Provide 6” PVC tube with two pipe caps (one solvent welded / one loose) mounted to wall for holding one set of Record Prints. Locate where indicated in Drawings, if not indicated coordinate location with Owner and Architect.

B. Record Specifications: Submit annotated PDF electronic files and 3 paper copies of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories and 3 paper copies of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories and 3 paper copies of each submittal.

E. Reports: Submit written report monthly indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Locations of concealed internal utilities.
i. Changes made by Change Order or Construction or Work Change Directive.
j. Changes made following Architect's written orders.
k. Details not on the original Contract Drawings.
l. Field records for variable and concealed conditions.
m. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

1.5 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file and paper copy.

1.6 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file and paper copy.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.7 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file and paper copy.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.8 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Contractor's responsibilities for demonstration and training of Owner's representatives relative to operation and maintenance of miscellaneous building equipment and systems.

1.3 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS

A. Related Sections with demonstration and training requirements include the following:

Division 22

22 34 00 - Fuel-Fired, Domestic-Water Heaters

Division 23

23 54 16.13 - Gas-Fired Furnaces
23 55 23.13 - Low Intensity, Gas Fired, Tube Heaters
23 72 23.19 - Packaged Indoor Fixed Plate Energy Recovery Units
23 73 33.16 - Indoor, Indirect, Gas-Fired Heating And Ventilating Units

23 81 26 - Split-System Air-Conditioners

Division 26

26 22 00 - Low-voltage Transformers

Division 28

28 46 00 - FIRE DETECTION AND ALARM

1.4 INFORMATIONAL SUBMITTALS

A. The following information shall be submitted to the Construction Manager for the Owner's review and approval prior to training taking place.

1. Name and qualifications of demonstrator/trainer.
2. Written outline of training.
3. Samples of training material and handouts to be utilized during the training.
4. Copies of Operation and Maintenance Manual for reference and review during the training.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Demonstration and Training shall occur concurrent with Project Completion, Project Closeout and transfer of the building to the Owner for occupancy in as much as possible.

B. Demonstration and Training shall be defined as presentation of the equipment and systems to the Owner's representatives in a manner that fully educates and extends the knowledge necessary to understand, operate, adjust, maintain, and modify settings where applicable, and recognize dangers and safeguards where applicable.

C. Owner Representatives shall be defined to include but not be limited to: administrative staff, teaching staff, child nutrition/food service staff, custodial staff and maintenance staff. Owner shall coordinate among the school departments and assemble the representatives necessary to participate in each individual training section.

D. Contractor shall be responsible to coordinate and propose a schedule of training dates and times for the individual sections to the Construction Manager. The proposed schedule shall be submitted with sufficient lead time to allow the Owner confirmation availability of pertinent staff, but not less than 72 hours.

E. Demonstration and Training shall be performed by an authorized and factory trained representative, or trade specialist, wholly knowledgeable of the equipment or system construction, operation, programming, and maintenance requirements.

F. Equipment and systems being demonstrated shall be complete and pre-tested to insure they are in operational condition. Demonstration and training shall be cancelled in the field if it becomes obvious that this requirement has not been achieved.

3.2 DEMONSTRATION AND TRAINING PROCEDURE

A. The demonstration and training shall occur on the project site and at the location of the equipment and systems and shall include but not be limited to the following scope of activities.

1. An overview of the physical scope and extent of the equipment and/or systems.

2. A description of the equipment/system construction.

3. A description of the equipment/system multiple components and operating parts.

4. A description of the equipment/system controls, manual or electronic.

5. A demonstration of the equipment/system start-up, operation, and shut-down.

6. A demonstration of equipment/system controls adjustment and manipulation.

7. A description of the maintenance, cleaning and adjustment requirements.

8. A demonstration of maintenance, cleaning and adjustment operations.

9. A description and instruction concerning the most common operation or maintenance issues.

10. A description and instruction with listing of basic control settings in the event the equipment/system experiences power or other service failure.

11. A description and instruction concerning safety issues and requirements.

12. Hands-on operation of the equipment/system by the owner's representatives to ensure demonstration and training understanding.

13. Explanation of the equipment/system warranty including an explanation of repair protocol and exchange of contact information affecting the same.

14. All attendees to the demonstration and training session shall sign an attendance sheet captioned for the project, contract, equipment section/equipment and date. A copy of the attendance sheet shall be included in the Operation and Maintenance Manual.

15. Handouts shall be provided for Owner staff in attendance at each session and include, but not be limited to, basic trouble shooting information

END OF SECTION 01 79 00 DEMONSTRATION AND TRAINING

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected site elements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

C. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structure.
   3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
   2. Interruption of utility services. Indicate how long utility services will be interrupted.
   3. Coordination for shutoff, capping, and continuation of utility services.

C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Submit before Work begins.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 FIELD CONDITIONS

A. Notify Construction Manager of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

B. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. Hazardous materials will be removed by Owner before start of the Work.
   2. If suspected hazardous materials are encountered, do not disturb; immediately notify Construction Manager and Owner. Hazardous materials will be removed by Owner under a separate contract.

C. Storage or sale of removed items or materials on-site is not permitted.

D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs or video and templates.
   1. Existing site shall be videoed with date and time to show existing conditions prior to work being performed. Video shall be delivered to CMR prior to construction operations in DVD format.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
   2. Arrange to shut off utilities with utility companies.
   3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
   2. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire- suppression devices during flame-cutting operations.
   3. Maintain fire watch during and for at least two hours after flame-cutting operations.
   4. Maintain adequate ventilation when using cutting torches.
   5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Construction Manager, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

SECTION 03 20 00 - CONCRETE REINFORCING

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of Architect.

1.3 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

2.2 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.

B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch (1.2908 mm) in diameter.

1. Finish: Plain

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches.

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel-reinforcement placement.

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Blended hydraulic cement.
4. Aggregates.
5. Admixtures:

a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

6. Vapor retarders.
7. Liquid floor treatments.
8. Curing materials.
9. Joint fillers.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.

6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
10. Intended placement method.
11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

a. Location of construction joints is subject to approval of the Architect.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Final finish for floors.
5. Curing process.
6. Floor treatment if any.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Vapor retarders.
5. Joint-filler strips.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Blended hydraulic cement.
4. Aggregates.
5. Admixtures:

C. Research Reports: For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.

D. Preconstruction Test Reports: For each mix design.

1.5 QUALITY ASSURANCE

A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1. Include the following information in each test report:

a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II.
2. Fly Ash: ASTM C618, Class C or F.

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C260/C260M.

D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

E. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F: Black.
b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
c. Ambient Temperature Above 85 deg F (29 deg C): White.

C. Curing Paper: 8-feet- wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.

D. Water: Potable or complying with ASTM C1602/C1602M.

E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

F. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.5 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

2.6 CONCRETE MIXTURES

A. Class A: Normal-weight concrete used for footings.

1. Exposure Class: ACI 318 F0 S0 W0 C0.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.55.
4. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

B. Class B: Normal-weight concrete used for interior slab on grade and walls.

1. Exposure Class: ACI 318 (ACI 318M) F0 S0 W0 C0.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.50
4. Air Content:

    a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
5. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

C. Class C: Normal-weight concrete used for exterior frost slabs.

1. Exposure Class: ACI 318 F3 S0 W0 C1.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.45
4. Air Content:

    a. 6 percent plus or minus 1 percent.

5. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.2 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.3 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

a. Continue reinforcement across construction joints unless otherwise indicated.
b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Locate joints for slabs at third points of spans.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.4 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

a. Do not use vibrators to transport concrete inside forms.
b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.5 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch and also no more than 1/16 inch in 2 feet.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated on Drawings. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.

2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive finish to concrete stair treads, platforms, ramps as indicated on Drawings

1. Apply in accordance with manufacturer's written instructions.

3.6 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 6 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings.
3. Minimum Compressive Strength: 4000psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.

    a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.7 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.

3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.
    1)

B. Curing Unformed Surfaces: Comply with ACI 308.1 and as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

    a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

            a) Lap edges and ends of absorptive cover not less than 12 inches.
            b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

        2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

            a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
            b) Cure for not less than seven days.

        3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

            a) Water.
            b) Continuous water-fog spray.

    b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

            a) Lap edges and ends of absorptive cover not less than 12 inches.
            b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

        2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

            a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
            b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

c. Floors to Receive Polished Finish: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

d. Floors to Receive Chemical Stain:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
3) Butt sides of curing paper tight; do not overlap sides of curing paper.
4) Leave curing paper in place for duration of curing period, but not less than 28 days.

e. Floors to Receive Urethane Flooring:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches (150 mm) and sealed in place.
3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

3.8 TOLERANCES

A. Conform to ACI 117.

3.9 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
3. Rinse with water; remove excess material until surface is dry.
4. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

    a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 28 days.
        11) Concrete mixture designation, proportions, and materials.
        12) Field test results.
        13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
        14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Verification of use of required design mixture.
2. Concrete placement, including conveying and depositing.
3. Curing procedures and maintenance of curing temperature.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete.

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

3. Concrete Temperature: ASTM C1064/C1064M:

    a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

4. Compression Test Specimens: ASTM C31/C31M:

    a. Cast and laboratory cure two sets of 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.

5. Compressive-Strength Tests: ASTM C39/C39M.

    a. Test one set of three laboratory-cured specimens at seven days and one set of three specimens at 28 days.
    b. A compressive-strength test to be the average compressive strength from a set of three specimens obtained from same composite sample and tested at age indicated.

6. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

7. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
8. Additional Tests:

a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.

9. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
10. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.11 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 03 30 00

SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout materials.
3. Reinforcement.
4. Embedded flashing.
5. Accessories.
6. Mortar and grout mixes.

B. Related Requirements:

1. Section 01 43 39 "Mockups" for integrated exterior mockup requirements.
2. Section 07 19 00 "Water Repellents" for water repellents applied to unit masonry assemblies.
3. Section 07 21 00 "Thermal Insulation" for cavity wall insulation.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315R.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Weep/cavity vents.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.

b. For masonry units, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellent used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined in accordance with TMS 602.

D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installers: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. For exposed masonry units and cementitious mortar components, obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) in accordance with TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms in accordance with ASTM C1314.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, use the equivalent thickness method for masonry units in accordance with ACI 216.1.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, will show no visible water or leaks on the back of test specimen.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) ACM Chemistries.
2) Euclid Chemical Company (The); an RPM company.
3) GCP Applied Technologies Inc.
4) Master Builders Solutions.

C. CMUs: ASTM C90, weight as indicated on Structural Drawings.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength as indicated on Structural Drawings.

2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

D. Decorative CMUs: ASTM C90, weight as indicated on Structural Drawings.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength as indicated on Structural Drawings.
2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
3. Pattern and Texture: Standard pattern, smooth-face finish.
4. Colors: Colored units as indicated on Architectural Drawings.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following

1) Argos USA LLC
2) Heidelberg Materials
3) Holcim (US) Inc

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments do not exceed 10 percent of portland cement by weight.

E. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C404.

G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ACM Chemistries.
b. Euclid Chemical Company (The); an RPM company.
c. GCP Applied Technologies Inc.
d. Master Builders Solutions.

H. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Heckmann Building Products, Inc.
b. Hohmann & Barnard, Inc.
c. Wire-Bond.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Interior Walls: Mill- galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Wire Size for Veneer Ties: 0.148-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 ft., with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Heckmann Building Products, Inc.
b. Hohmann & Barnard, Inc.
c. Wire-Bond.

E. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Heckmann Building Products, Inc.

b. Hohmann & Barnard, Inc.
c. Wire-Bond.

2. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

2.7 EMBEDDED FLASHING

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 316, 0.016 inch thick.
2. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
3. Solder metal items at corners.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Copper-Fabric Flashing: 5 oz./sq. ft. copper sheet bonded between two layers of glass-fiber cloth.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Advanced Building Products Inc.
2) Hohmann & Barnard, Inc.
3) STS Coatings, Inc.
4) Wire-Bond.
5) York Manufacturing, Inc.

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

D. Termination Bars for Flexible Flashing: Stainless steel bars 0.075 inch by 1 inch.

2.8 ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

D. Weep/Cavity Vents: Use the following where indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Advanced Building Products Inc.
        2) Heckmann Building Products, Inc.
        3) Hohmann & Barnard, Inc.
        4) Wire-Bond.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Mortar Deflector: Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches that prevent clogging with mortar droppings.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Advanced Building Products Inc.
        2) Hohmann & Barnard, Inc.
        3) Keene Building Products.
        4) Mortar Net Solutions.
        5) Wire-Bond.
        6) York Manufacturing, Inc.

F. Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
    b. EaCo Chem, Inc.
    c. PROSOCO, Inc.

2.9 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type M.
3. For exterior, above-grade, load-bearing, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, paragraph 4.2.1.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build non load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 43 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units and hollow brick with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

E. Cut joints flush where indicated to receive waterproofing, cavity wall insulation, and/or air barriers unless otherwise indicated.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together as follows:

1. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

a. Use adjustable-type (two-piece-type) reinforcement to allow for differential movement regardless of whether bed joints align.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 incheso.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as indicated.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at corners by using prefabricated L-shaped units.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Install preformed control-joint gaskets designed to fit standard sash block.

C. Form control joints in concrete masonry veneer as follows:

1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 07 92 00 "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, across airspace, and up exterior face of interior wythe at least 8 inches. Fasten upper edge of flexible flashing to masonry through termination bar.
3. At lintels and shelf angles, extend flashing 6 inches minimum, to edge of next full unit at each end. At heads and sills, extend flashing 6 inches minimum, to edge of next full unit and turn ends up not less than 2 inches to form end dams.
4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

C. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Space weep holes a maximum of 24 inches o.c. unless otherwise indicated.
3. Space weep holes formed from plastic tubing 16 incheso.c.

D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.

3.10 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.11 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with a proprietary acidic masonry cleaner applied according to manufacturer's written instructions.

3.12 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 20 00 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.

2. Shrinkage-resistant grout

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Threaded rods.
5. Shop primer.
6. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

C. Delegated Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Mill test reports for structural-steel materials, including chemical and physical properties.

C. Source quality-control reports.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:
1. Fabricator's experienced steel detailer selects or completes connections in accordance with ANSI/AISC 303.

2. Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.

C. Moment Connections: See drawings.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992.

B. Channels, Angles: ASTM A36.

C. Plate and Bar: ASTM A36.

D. Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.

E. Steel Pipe: ASTM A53, Type E or Type S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts with plain finish.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36.
1. Finish: Hot-dip zinc coating, ASTM A153 Class C.

B. Headed Anchor Rods: ASTM F1554, Grade 36, straight.

1. Finish: Hot-dip zinc coating, ASTM A153.

C. Threaded Rods: ASTM A36

1. Finish: Hot-dip zinc coating, ASTM A153.

2.5 PRIMER

A. Steel Primer:
1. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.6 SHRINKAGE-RESISTANT GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.

2. Surfaces to be field welded.
3. Galvanized surfaces.
4. Surfaces enclosed in interior construction.

2.11 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.

1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1.
4. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates, Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1.

a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1.

END OF SECTION 051200

SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Noncomposite form deck.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Roof deck.
2. Noncomposite form deck.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Welding certificates.
2. Product Certificates: For each type of steel deck.

B. Test and Evaluation Reports:

1. Product Test Reports: For tests performed by a qualified testing agency, indicating that power-actuated mechanical fasteners comply with requirements.
2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

D. Qualification Statements: For welding personnel.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding code:

    a. AWS D1.3/D1.3M.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

2.2 ROOF DECK

A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33, G60 zinc coating.

2. Deck Profile, depth and thickness: As indicated on drawings.

2.3 NONCOMPOSITE FORM DECK

A. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite deck panels used as a form to comply with SDI NC, with the minimum section properties indicated, and with the following:

1. Galvanized-Steel Sheet: ASTM A653, Structural Steel (SS), Grade 33 G60 zinc coating.

2. Deck profile, depth and thickness: As indicated on drawings.

2.4 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

C. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi , not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

E. Pour Stops: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile by SDI standards for overhang and slab depth.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

G. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

H. Galvanizing Repair Paint: ASTM A780.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.2 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as indicated as the drawings.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span and as indicated on the drawings.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.3 INSTALLATION OF FLOOR DECK

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as indicated on the drawings.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span and as indicated on the drawings.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.

a. Field welds will be subject to inspection.

2. Steel decking will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 053100

SECTION 05 51 13 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.
2. Steel tube railings and guards attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs, railings, and guards.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
2. Deliver such items to Project site in time for installation.

C. Schedule installation of railings and guards so wall attachments are made only to completed walls.

1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For metal pan stairs and the following:

1. Welded-wire mesh.
2. Abrasive nosings.
3. Shop primer products.
4. Handrail wall brackets.
5. Grout.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

C. Samples for Verification: For each type and finish of nosing.

D. Delegated Design Submittal: For stairs, railings and guards, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.

1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect steel members and packaged materials from corrosion and deterioration.
3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design stairs, railings and guards, including attachment to building construction.

B. Structural Performance of Stairs: Metal stairs withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.

5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Tubing for Railings and Guards: ASTM A500/A500M (cold formed) or ASTM A513/A513M.

1. Provide galvanized finish for installations.

D. Galvanized Steel Sheet: ASTM A653/A653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.

E. Welded-Wire Mesh: Square pattern, 2-inch welded-wire mesh, made from 0.236-inch nominal-diameter steel wire complying with ASTM A510/A510M.

F. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

2.3 ABRASIVE NOSINGS

A. Extruded Units: Aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Wooster Products Inc; 630B or a comparable product by one of the following:

a. American Safety Tread Co., Inc.
b. Balco; a CSW Industrials Company.

c. Nystrom, Inc.

2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
3. Nosings, Two-Piece Units: 3 inches wide, with subchannel for casting into concrete.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.4 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12.

1. Select fasteners for type, grade, and class required.

B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.

C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be galvanized.

E. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Wall Brackets: As required based on design.

B. Welding Electrodes: Comply with AWS requirements.

C. Shop Primers: Provide primers that comply with Section 09 96 00 “High-Performance Coatings”.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 or ASTM A780/A780M and compatible with paints specified to be used over it.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

G. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

H. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.6 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings and guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Assemble stairs, railings, and guards in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of welded joint.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that will be exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.7 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Commercial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Stringers: Fabricate of steel channels.

a. Stringer Size: As required to comply with "Performance Requirements" Article.
b. Provide closures for exposed ends of channel and rectangular tube stringers.
c. Finish: Shop primed.

2. Platforms: Construct of steel channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.

a. Provide closures for exposed ends of channel and rectangular tube framing.
b. Finish: Shop primed.

3. Weld stringers to headers; weld framing members to stringers and headers.
4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.

1. Galvanized Steel Sheet: Galvanized steel sheet.
2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
3. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.8 FABRICATION OF STAIR RAILINGS AND GUARDS

A. Fabricate railings and guards to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: 1-1/2-inch-diameter top rails and 1-1/2-inch-diameter posts.
2. Intermediate Rails Infill: 1-1/2-inch-diameter intermediate rails spaced less than 21 inches clear.

B. Welded Connections: Fabricate railings and guards with welded connections.

1. Fabricate connections that are exposed to weather in a manner that excludes water.

a. Provide weep holes where water may accumulate internally.

2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
3. Weld all around at connections, including at fittings.
4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
5. Obtain fusion without undercut or overlap.

6. Remove flux immediately.
7. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of a welded joint.as shown in NAAMM AMP 521.

C. Form changes in direction of railings and guards as follows:

1. By bending.
2. By flush bends

D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing and guard members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

G. Connect posts to stair framing by direct welding unless otherwise indicated.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
2. For galvanized railings and guards, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
3. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.

1. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.9 FINISHES

A. Finish metal stairs after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

C. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1,

"Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.

1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.

a. Clean bottom surface of plates.
b. Set plates for structural members on wedges, shims, or setting nuts.
c. Tighten anchor bolts after supported members have been positioned and plumbed.
d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.

1) Neatly finish exposed surfaces; protect grout and allow to cure.
2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in "Fabrication, General" Article.

F. Place and finish concrete fill for treads and platforms to comply with Section 03 30 00 "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete.
2. Center nosings on tread width.

3.3 INSTALLATION OF RAILINGS AND GUARDS

A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.

1. Space posts at spacing indicated or, if not indicated, as required by design loads.
2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
4. Secure posts, rail ends, and guard ends to building construction as follows:

a. Anchor posts to steel by welding to steel supporting members.
b. Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.

B. Attach handrails to wall with wall brackets.

1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
2. Secure wall brackets to building construction as required to comply with performance requirements.

3.4 REPAIR

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 51 13

SECTION 06 10 00 - ROUGH CARPENTRY

1.1 SUMMARY

A. Section Includes:

1. Wood products.
2. Wood-preservative-treated lumber.
3. Fire-retardant-treated lumber.
4. Miscellaneous lumber.
5. Plywood backing panels.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. Lumber grading agencies, and abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
3. Dress lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1, Use categories as follows:

1. UC2: Interior construction not in contact with ground but may be subject to moisture.
2. UC3B (All Other Commodity Specifications): Uncoated products excluding sawn products in exterior construction not in contact with ground, exposed to all weather cycles including prolonged wetting.
3. UC4A (All Other Commodity Specifications): Non-critical products excluding sawn products in contact with ground and exposed to all weather cycles, normal exposure conditions.
4. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

4. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED LUMBER

A. General: Where fire-retardant-treated materials are indicated, materials are to comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment is not to promote corrosion of metal fasteners.
2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by authorities having jurisdiction.

E. Application: Treat all exterior rough carpentry unless otherwise indicated and the following:

1. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.

C. Roofing Nailers: Structural- or No. 2-grade lumber or better; kiln-dried Douglas fir, southern pine, or wood having similar decay-resistant properties.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.6 FASTENERS

A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

K. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

SECTION 07 19 00 - WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrating water repellents.

B. Related Requirements:

1. Section 04 20 00 "Unit Masonry" for integral water-repellent admixture for unit masonry assemblies.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Penetrating water repellents.

B. Product Data Submittals:

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Applicator.

B. Product Certificates: For each type of water repellent.

C. Preconstruction Test Reports: For water-repellent-treated substrates.

D. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

1.6 FIELD CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied in accordance with manufacturers' written instructions and warranty requirements:

1. Concrete surfaces and mortar have cured for not less than 28 days.
2. Building has been closed in for not less than 30 days before treating wall assemblies.
3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
5. Rain or snow is not predicted within 24 hours.
6. Not less than 24 hours have passed since surfaces were last wet.
7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Water Absorption: Minimum 90 percent reduction of water absorption after 24 hours for treated compared to untreated specimens when tested according to the following:

1. Cast-in-Place Concrete: ASTM C642.
2. Precast Concrete: ASTM C642.
3. Cast Stone: ASTM C1195.
4. Concrete Masonry Units: ASTM C140.
5. Clay Brick: ASTM C67.
6. Natural Stone: ASTM C97/C97M.
7. Portland Cement Plaster (Stucco): ASTM D6532.

B. Water Penetration and Leakage through Masonry: Minimum 85 percent reduction in leakage rate of treated compared to untreated specimens, in accordance with ASTM E514/E514M.

C. Durability: Maximum 5 percent loss of water-repellent performance after 2500 hours of weathering in accordance with ASTM G154 compared to water-repellent-treated specimens before weathering.

D. Chloride-Ion Intrusion in Concrete: NCHRP Report 244, Series II tests.

1. Reduction of Water Absorption: 80 percent.
2. Reduction in Chloride Content: 80 percent.

2.2 PENETRATING WATER REPELLENTS

A. Penetrating Low-VOC Silane/Siloxane-Blend Water Repellent: Clear, containing 5 percent or more active content of silane and siloxane blend with 400 g/L or less of VOCs.

1. Basis-of-Design Product: Subject to compliance with requirements, provide PROSOCO, Inc; Saltguard WB or a comparable product by one of the following:

a. Ghostshield.
b. TK Products Construction Coatings, a Fenix Group SPC Company.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry in accordance with water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
3. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level in accordance with water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, in accordance with repellent manufacturer's written instructions.

B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product in accordance with water-repellent manufacturer's written instructions and as follows:.

1. Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents in accordance with ASTM E1857.
2. Clay Brick Masonry: ASTM D5703.

C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.

D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION OF WATER REPELLENTS

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply coating of water repellent on surfaces to be treated using 15 psi-pressure spray with a fan-type spray nozzle roller or brush to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:

1. Owner will engage the services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor to remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect..

B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.

1. Notify Architect seven days in advance of the dates and times when surfaces will be tested.
2. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 07 19 00

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Miscellaneous Void insulation.

B. Related Requirements:

1. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Extruded polystyrene foam-plastic board insulation.
2. Miscellaneous Void insulation.
3. Accessories

1.3 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. Sign, date, and post the certification in a conspicuous location on Project site.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than 75 and 450 when tested in accordance with ASTM E84.

B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

C. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

D. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

E. Thermal-Resistance Value (R-Value): Min. R-5 / inch in accordance with ASTM C518. Provide the following R-Values unless otherwise indicated on Drawings:

1. R-Value at Underslab: 2 inch Min. R-10.
2. R-Value at Foundation Wall (under base flashing): 3 inch – Min. R-15.
3. R-Value at Cavity Wall (above base flashing): 2.5 inch – Min. R-12.5.

2.2 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. DiversiFoam Products.
b. DuPont de Nemours, Inc.
c. Owens Corning.
d. The Dow Chemical Company.

2.3 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids and penetrations with spray foam insulation or as otherwise recommended by insulation manufacturer to result in tight seal. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation to top of foundation.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.

1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.

3.6 INSTALLATION OF MISCELLANEOUS VOID INSULATION

A. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 27 26 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Air barriers, vapor permeable.

1.2 DEFINITIONS

A. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

B. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

C. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

1. Air barriers, vapor permeable.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

    a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
    b. Include junction with other membranes, building corner condition, and foundation wall intersection.
    c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain primary air-barrier materials and air-barrier accessories from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested in accordance with ASTM E2357.

C. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. pressure difference; ASTM E2178.

D. Ultimate Elongation: Minimum 250 percent; ASTM D412, Die C.

E. Adhesion to Substrate: Minimum 30 lbf/sq. in. when tested in accordance with ASTM D4541.

F. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

G. UV Resistance: Can be exposed to sunlight for 180 days in accordance with manufacturer's written instructions.

2.3 AIR BARRIERS, VAPOR PERMEABLE

A. Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, over smooth, void-free substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Coatings & Waterproofing Inc; Barrithane VP.
b. DuPont de Nemours, Inc.; DuPont Tyvek Fluid Applied WB.
c. Hohmann & Barnard, Inc; Enviro-Barrier VP.
d. Sto Corp.; Sto AirSeal®.
e. W. R. Meadows, Inc; Air-Shield LMP.

2. Vapor Permeance: Minimum 5 perms; ASTM E96/E96M, Procedure A, Desiccant Method or Procedure B, Water Method.

2.4 ACCESSORY MATERIALS

A. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to

produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.

C. Stainless Steel Sheet: ASTM A240/A240M, Type 304, 0.0250 inch thick, and Series 300 stainless steel fasteners.

D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method in accordance with ASTM D4263.
4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate in accordance with manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Bridge isolation joints, expansion joints, and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement in accordance with manufacturer's written instructions and details.

3.3 INSTALLATION OF ACCESSORIES

A. Install accessory materials in accordance with air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 INSTALLATION OF PRIMARY AIR-BARRIER MATERIAL

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier in accordance with air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.

1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

B. Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.

1. Vapor-Permeable, Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.

C. Do not cover air barrier until it has been tested and inspected by testing agency.

D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, in accordance with manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials in accordance with air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 07 27 26

SECTION 07 72 53 - SNOW GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rail-type, seam-mounted snow guards.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

1. Rail-type, seam-mounted snow guards.

B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.

1. Include details of rail-type snow guards.

C. Samples:

1. Rail-Type Snow Guards: Bracket, 12-inch-long rail, and installation hardware.

D. Delegated Design Submittals: For snow guards, include analysis reports signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include calculation of number and location of snow guards.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that the engineer is licensed in the state in which the Project is located.

B. Product Test Reports: For each type of snow guard, for tests performed by a qualified testing agency, indicating load at failure of attachment to roof system identical to roof system used on this Project.

1.4 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit adhesive-mounted snow guards to be installed, and adhesive cured, according to adhesive manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design snow guards, including attachment to roofing material and roof deck, as applicable for attachment method, based on the following:

1. Roof snow load.
2. Snow drifting
3. Roof slope.
4. Roof type.
5. Roof dimensions.
6. Roofing substrate type and thickness.
7. Snow guard type.
8. Snow guard fastening method and strength.
9. Snow guard spacing.
10. Coefficient of Friction Between Snow and Roof Surface: 0.
11. Factor of Safety: 3.

B. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

C. Structural Performance: Snow guards to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Snow Loads: As indicated on Drawings.

2.2 RAIL-TYPE SNOW GUARDS

A. Rail-Type, Seam-Mounted Snow Guards:

1. Manufacturers: Subject to compliance with requirements, and with written approval of the metal roof manufacturer, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Alpine SnowGuards.
b. Berger; division of OmniMax International, Inc.
c. IceBlox Inc.
d. LMCurbs.
e. PMC Industries, Inc.
f. Rocky Mountain Snow Guards, Inc.
g. S-5! Metal Roof Innovations, Ltd.
h. TRA Snow and Sun, Inc.

2. Description: Snow guard rails fabricated from metal pipes, bars, or extrusions, anchored to brackets and equipped with two rails.
3. Bars: ASTM A240/A240M, Type 304 stainless steel; 320-grit polished finish, oil-ground, uniform, fine, directionally textured finish.

a. Profile: Round.

4. Seam Clamps: ASTM A240/A240M, Type 304 stainless steel; with stainless steel set screws incorporating round nonpenetrating point; designed for use with applicable roofing system to which clamp is attached.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.

1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare substrates for bonding snow guards.

B. Prime substrates according to snow guard manufacturer's written instructions.

3.3 INSTALLATION

A. Install snow guards according to manufacturer's written instructions.

1. Space rows as recommended by manufacturer.

B. Attachment for Standing-Seam Metal Roofing:

1. Do not use fasteners that will penetrate metal roofing or fastening methods that void metal roofing finish warranty.
2. Rail-Type, Seam-Mounted Snow Guards:

a. Install brackets to vertical ribs in straight rows.
b. Secure with stainless steel set screws, incorporating round nonpenetrating point, on same side of standing seam.
c. Torque set screw in accordance with manufacturer's written instructions.
d. Install cross members to brackets.

END OF SECTION 07 72 53

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer.

C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

D. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

E. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

F. Field-Adhesion-Test Reports: For each sealant application tested.

G. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with stone and masonry substrates.
4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Joint Sealant Products: See Schedule in Part 3.

2.2 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), Type O (open-cell material,) Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.3 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old

joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.
4. Provide flush joint profile according to Figure 8B in ASTM C1193.
5. Provide recessed joint configuration of recess depth according to Figure 8C in ASTM C1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

    a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
    b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

    a. Whether sealants filled joint cavities and are free of voids.
    b. Whether sealant dimensions and configurations comply with specified requirements.
    c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

Type 1 - General Purpose Paintable Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF, single component, non-staining, non-bleeding, non-sagging, paintable.

1. Applications: Generally Interior Sealant for painted conditions.

    a. Generally all non-traffic interior locations.
    b. Interior perimeter of window and door frames.
    c. Control and construction joints.
    d. Miscellaneous openings and penetrations.
    e. Joints between dissimilar materials.
    f. Interior wall and ceiling control joints.
    g. Interior joints between door and window frames and wall surfaces.
    h. Joints on precast beams and planks.
    i. Perimeter joints between interior wall surfaces and frames of interior doors, windows, storefronts, louvers, elevator entrances and similar openings.
    j. Other interior joints for which no other type of sealant is indicated.
    k. Other joints as indicated.

B. Type 2 - General Purpose Paintable Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 50, Uses M, O, and A; single component, paintable.

1. Applications: Generally Exterior Sealant for painted conditions.

    a. Control, expansion, and soft joints in masonry.
    b. Joints between concrete and other materials.
    c. Joints between metal frames and other materials.
    d. Control and expansion joints in cast-in-place concrete.
    e. Joints between precast concrete units.
    f. Control and expansion joints in stone masonry.
    g. Butt joints between metal panels.
    h. Joints between different materials listed above.
    i. Perimeter joints between materials listed above and frames of doors, windows, storefronts, louvers and similar openings.
    j. Control and expansion joints in soffits and overhead surfaces.
    k. Other exterior joints in vertical surfaces and non-traffic horizontal surfaces for which no other sealant is specified.

C. Type 3 - General Purpose Color Matched Exterior Sealant: Silicone; Non-Staining, Neutral Moisture Curing, ASTM C920, Grade NS, Class 50, Uses M, O, and A; single component, custom color matched to adjacent finishes, reduced dirt pick-up.

1. Applications: Generally Exterior Sealant for non-painted conditions.

a. Control, expansion, and soft joints in masonry.
b. Joints between concrete and other materials.
c. Joints between metal frames and other materials.
d. Control and expansion joints in cast-in-place concrete.
e. Joints between precast concrete units.
f. Control and expansion joints in stone masonry.
g. Butt joints between metal panels.
h. Joints between different materials listed above.
i. Perimeter joints between materials listed above and frames of doors, windows, storefronts, louvers and similar openings.
j. Control and expansion joints in soffits and overhead surfaces.
k. Other exterior joints in vertical surfaces and non-traffic horizontal surfaces for which no other sealant is specified.

D. Type 4 - General Purpose Traffic Bearing Sealant: Urethane; ASTM C920, Grade NS, Class 50, single component.

1. Applications: Generally Interior and Exterior Sealant subject to traffic.

a. Interior and Exterior applications subject to traffic.
b. Control, expansion and isolation joints in cast-in-place concrete.
c. Joints between architectural precast concrete paving units.
d. Joints between different materials listed above.
e. Other interior and exterior traffic bearing joints in horizontal and sloped traffic surfaces.

E. Type 5 - General Purpose Traffic Bearing Sealant: Urethane; ASTM C920, Grade NS, Class 50, single component, custom color matched to adjacent finishes.

1. Applications: Generally Interior and Exterior Sealant subject to traffic for non-painted conditions.

a. Interior and Exterior applications subject to traffic.
b. Control, expansion and isolation joints in cast-in-place concrete.
c. Joints between architectural precast concrete paving units.
d. Tile control and expansion joints.
e. Joints between different materials listed above.
f. Other interior and exterior traffic bearing joints in horizontal and sloped traffic surfaces.

F. Type 6 - Mildew Resistant Acid Curing Sealant: Silicone; ASTM C920, Grade NS, Class 50, Uses M, O, and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.

1. Applications: Generally Interior Sealant for areas subject to water.

a. Perimeter of all plumbing fixtures and adjoining walls, floors, and counters.
b. All countertop backsplashes and all interfaces where a sink is located in the countertop.
c. Plumbing piping which penetrates a wall or floor and is exposed to view.

G. Type 7 - Acoustical Joint Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF, single component, non-staining, non-bleeding, non-sagging, paintable.

1. Applications: Generally Interior Acoustical Sealant for STC rated wall assemblies.
2. Product shall be effective in reducing airborne sound transmission through building construction as demonstrated by testing representative assemblies in accordance with ASTM E 90.

PART 4 - END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.
3. Borrowed Lights.

B. Related Requirements:

1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

C. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.

3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.

C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.8 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies is to meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 HOLLOW METAL DOORS AND FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door; AADG, Inc.; ASSA ABLOY.
2. Curries, AADG, Inc.; ASSA ABLOY Group.
3. Republic Doors and Frames; a Allegion brand.
4. Steelcraft; Allegion plc.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

B. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.50 deg Btu/F x h x sq. ft. when tested in accordance with ASTM C1363 or ASTM E1423.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch with minimum A40coating.
d. Edge Construction: Model 2, Seamless.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Core: Manufacturer's standard.
g. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch with minimum A40coating.
b. Sidelite and Transom Frames: Fabricated from same thickness and material as adjacent door frame.
c. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
d. Edge Construction: Model 2, Seamless.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Manufacturer's standard that meets performance requirements.
i. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.5 BORROWED LITES

A. Fabricate of Metallic-coated steel sheet, minimum thickness of 0.067 inch with minimum A40coating.

B. Construction: Full profile welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.7 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

2.8 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.9 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

4. Solidly pack mineral-fiber insulation inside frames.
5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
3. Smoke-Control Doors: Install doors in accordance with NFPA 105.

D. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint in accordance with manufacturer's written instructions.

C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish in accordance with manufacturer's written instructions.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames.

B. Related Requirements:

1. Section 23 33 00 "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.

C. Product Schedule: For access doors and frames.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ACUDOR Products, Inc.
b. Babcock-Davis.
c. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
d. Karp Associates, Inc.
e. Larsen's Manufacturing Company.
f. Nystrom, Inc.

2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
3. Optional Features: Piano hinges.
4. Locations: Wall and ceiling.
5. Door Size: 24” x 24” unless otherwise indicated on the drawings.
6. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
7. Frame Material: Same material, thickness, and finish as door.
8. Latch and Lock: Cam latch, key operated.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 316. Remove tool and die marks and stretch lines, or blend into finish.

D. Stainless Steel Flat Bars: ASTM A666, Type 316. Remove tool and die marks and stretch lines, or blend into finish.

E. Aluminum Extrusions: ASTM B221, Alloy 6063.

F. Aluminum Sheet: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

G. Frame Anchors: Same material as door face.

H. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

D. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

SECTION 08 36 13 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sectional-door assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For manufacturer's warranty and finish warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sectional doors to include in maintenance manuals.

B. Manufacturer's warranty.

C. Finish warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

B. Regulatory Requirements: Comply with provisions in the ICC A117.1 applicable to sectional doors.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Failure of components or operators before reaching required number of operation cycles.
c. Faulty operation of hardware.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
e. Delamination of exterior or interior facing materials.

2. Warranty Period: Two years from date of Substantial Completion.

B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain sectional doors from single source from single manufacturer.

1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

1. Design Wind Load: As indicated on Drawings.

2. Testing: In accordance with ASTM E330/E330M or DASMA 108 for garage doors and complying with DASMA 108 acceptance criteria.
3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.

    a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
    b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.

4. Operability under Wind Load: Design sectional doors to remain operable under design wind load, acting inward and outward.

2.3 SECTIONAL-DOOR ASSEMBLY

A. Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; Heavy-Duty Thermacore Model #592, or a comparable product by one of the following:

    a. Clopay Building Products.
    b. Haas Door; a Nofziger Company.
    c. Wayne Dalton; a division of Overhead Door Corporation.

B. Operation Cycles: Door components and operators capable of operating for not less than 50,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. when tested in accordance with ASTM E283 or DASMA 105.

D. U-Value: 0.057 Btu/sq. ft. x h x deg F.

E. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G60 zinc coating.

1. Door-Section Thickness: 2 inches.
2. Section Faces:

    a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
    b. Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.

        1) Steel Sheet Thickness: 0.015-inch nominal coated thickness.
        2) Surface: Manufacturer's standard, ribbed.

    c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:

1) Zinc-Coated (Galvanized) Steel Sheet: With minimum nominal coated thickness of dimension recommended in writing by manufacturer to comply with performance requirements.

3. End Stiles: Enclose open ends of sections with channel end stiles with thermal break, formed from galvanized-steel sheet not less than 16 gauge nominal coated thickness and welded to door section.
4. Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place.

    a. Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal (weatherseal).
    b. Hardware Locations: Provide reinforcement for hardware attachment.

5. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free insulation of type indicated below:

    a. Foamed-in-Place Insulation: Polyurethane, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load.
    b. Fire-Resistance Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E84.

F. Track: Manufacturer's standard, galvanized-steel, high-lift track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.

1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
2. Size: 3 inches wide.
3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.

    a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs.
    b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

G. Track: Manufacturer's standard, galvanized-steel, standard-lift track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.

1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
2. Size: 3 inches wide.
3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.

    a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs.
    b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

H. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom, top, and jambs of door.

I. Windows: Manufacturer's standard window units of shape and size and in locations indicated on Drawings. Set glazing in vinyl, rubber, or neoprene glazing channel. Provide removable stops of same material as door-section frames. Provide the following glazing:

1. Clear Polycarbonate Plastic: 5/8" triple wall, clear, horizontal, fire-retardant, UV-resistant, honeycomb structured polycarbonate glazing. Min. R-Value: 2.50.

J. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.

1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.

   a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
   b. Provide double-end hinges where required for doors more than 16 ft. wide unless otherwise recommended by door manufacturer in writing.

2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.

   a. Roller-Tire Material: Case-hardened steel.

K. Counterbalance Mechanism:

1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
2. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 7 to 1.
3. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
4. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
5. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

L. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
3. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use.
4. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
5. Operator Type: Side mounted Jackshaft, as indicated in the Schedule.

   a. Basis-of-Design: Overhead Door Corporation; Model RSX.

6. Motor: Reversible-type with controller (disconnect switch) for interior, clean, and dry or exterior, dusty, wet, or humid motor exposure as indicated in Schedule. Use adjustable motor-mounting bases for belt-driven operators.

    a. Motor Size: As required to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
    b. Electrical Characteristics:

        1) Phase: Single phase.
        2) Volts: 120 V.

7. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
8. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.

    a. Monitored Entrapment Protection: Light Curtain designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.

        1) Basis-of-Design: Miller Edge; Model # MLC-K72 or # MLC-K36 as scheduled.

9. Control Station: Surface mounted, three-position (open, close, and stop) control.

    a. Operation: Push button. Integrate card reader where indicated in Schedule.
    b. Interior-Mounted Unit: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 standard-duty, or weatherproof-type, NEMA ICS 6, Type 4 enclosure, where indicated in Schedule.
    c. Exterior-Mounted Unit: Weatherproof-type, NEMA ICS 6, Type 4 enclosure, where indicated in Schedule.
    d. Features: Provide the following:

        1) Vehicle detection operation.
        2) Radio-control operation.
        3) Light Curtain operation.

10. Transmitters: Provide each sectional door with number of remote control operators as scheduled. Each transmitter shall control a minimum of four doors. The exact quantity, quantity per door, and programming shall be verified with the Owner. System must accommodate up to 250 transmitters total.
11. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
12. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

M. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

    1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating

manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

a. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.

B. Tracks:

1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install in accordance with UL 325.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

D. Touchup Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

3.6 SCHEDULE

A. Location: Door(s): All Sectional Doors

1. Track Type: Standard Lift.
2. Operator Type: Jackshaft, side mounted.

    a. Provide with emergency operation disconnect device and chain hoist.

3. Motor: For interior, clean, and dry exposure.
4. Obstruction Detection: Miller Edge; Model # MLC-K72.
5. Exterior Control Station: None
6. Interior Control Station: NEMA ICS 6, Type 1 standard-duty enclosure.
7. Transmitter: (2) each door.
8. Exhaust Port: (1) each door.

END OF SECTION 08 36 13

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed entrance and storefront systems.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Aluminum-framed entrance and storefront systems.

B. Product Data Submittals: For each product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories.

C. Shop Drawings:

1. Plans, elevations, sections, full-size details, and attachments to other work.
2. Details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
3. Full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrance and storefront systems, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

4. Connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
5. Point-to-point wiring diagrams showing the following:

a. Power requirements for each electrically operated door hardware.
b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

6. Signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

E. Samples for Verification: Actual sample of finished products for each type of exposed finish.

1. Size: Manufacturers' standard size.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

G. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

H. Delegated Design Submittals: For aluminum-framed entrances and storefront systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: For aluminum-framed entrance and storefront systems, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront system.

B. Product Test Reports: For aluminum-framed entrance and storefront systems, for tests performed by a qualified testing agency.

C. Source Quality-Control Reports: For aluminum-framed entrance and storefront systems.

D. Field Quality-Control Reports: For aluminum-framed entrance and storefront systems.

E. Qualification Statements:

1. For Installer.

F. Delegated Design Engineer Qualifications: For aluminum-framed entrance and storefront systems.

G. Sample Warranties: For aluminum-framed entrance and storefront systems.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For aluminum-framed entrance and storefront systems.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Entity that is certified under the North American Contractor Certification Program (NACC) and that employs installers and supervisors who are trained and approved by manufacturer and who are certified under the Architectural Glass and Metal Technician (AGMT) certification program.

B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of aluminum-framed entrance and storefront systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design aluminum-framed entrance and storefront systems.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance and storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrance and storefront systems to withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
3. Cantilever Deflection: Limited to 2L/175 at unsupported cantilevers.

E. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. 10 lbf/sq. ft..

G. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

   a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.41 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
   b. Entrance Doors: U-factor of not more than 0.68 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.

2. Solar Heat-Gain Coefficient (SHGC):

   a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.26 as determined in accordance with NFRC 200.
   b. Entrance Doors: SHGC of not more than 0.25 as determined in accordance with NFRC 200.

3. Air Leakage:

   a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested in accordance with ASTM E283.
   b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

4. Condensation Resistance Factor (CRF):

   a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined in accordance with AAMA 1503.
   b. Entrance Doors: CRF of not less than 63 as determined in accordance with AAMA 1503.

H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.

   a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
   b. Low Exterior Ambient-Air Temperature: 0 deg F.
   c. Interior Ambient-Air Temperature: 75 deg F.

2.3 ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer Company, Inc.; Arconic Corporation; Trifab VersaGlaze 451 T or a comparable product by one of the following:

1. OldCastle BuildingEnvelope (OBE).
2. Tubelite Inc.
3. YKK AP America Inc.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Interior Vestibule Framing Construction: Nonthermal.
3. Glazing System: Retained mechanically with gaskets on four sides.
4. Glazing Plane: Center.
5. Finish: Color anodic finish.
6. Fabrication Method: Field-fabricated stick system.
7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
8. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Wide stile; 5-inch nominal width.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
4. Finish: Match adjacent storefront framing finish.

2.4 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."

B. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

C. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

2.5 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

2.6 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.7 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

E. Rigid PVC filler.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using Manufacturer's standard fabrication method.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior and exterior doors, provide compression weather stripping at fixed stops.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.9 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: Black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

K. Install entrance doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

L. Install glazing as specified in Section 08 80 00 "Glazing."

3.3 ERECTION TOLERANCES

A. Install aluminum-framed entrance and storefront systems to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 MAINTENANCE SERVICE

A. Entrance Door Hardware Maintenance:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

END OF SECTION 08 41 13

SECTION 08 71 00 - DOOR HARDWARE

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary ConditionsandDivision1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This section includes the following:

1. Hinges.
2. Lock cylinders and keys.
3. Lock and latch sets.
4. Bolts.
5. Push/pull units.
6. Closers.
7. Overhead stops
8. Kick plates.
9. Smoke Seals
10. Card Readers
11. Access Control System

C. Related Sections: The following Sections may contain requirements that relate to this Section:

1. Division 1 General Requirements
2. Division 6 Wood and Plastics
3. Division 8 Doors and Windows
4. Division 26 Electrical
5. Division 28 Electronic Security and Safety

E. Regarding electrical hardware:
1. Wiring diagrams are to be provided for all openings with electrical hardware and are to be stamped by a
DHI certified EHC (Electrical Hardware Consultant) or AHC (Architectural Hardware Consultant). Diagrams are to include an elevation for each door, point to point hook-up for all devices, and a system diagram. Elevations and System diagrams are to be included with the door hardware schedule submittal. Point to point diagrams follow an electrical meeting with Owner, Architect, General Contractor, Electrical Contractor, Access Control provider and Security Contractor.
2. The hardware supplier shall supply a written description of the operation of each electrical door as part of their submittals.
3. Electrical hardware shall be provided from the manufacturer of the lock or exit device. No hardware shall be forwarded to a secondary source for modification or electrification.
4. All power transfers shall be supplied with factory wiring inside the hardware (similar to Von Duprin EPT power transfers). No power transfers shall be supplied without the wiring already in the device.

F. Where new hardware is being furnished for existing doors, it shall be the responsibility of the hardware supplier to review the existing doors and notify the architect of any problems prior to ordering any materials.

G. It shall be the responsibility of the hardware supplier to properly size all hardware and to go to each existing opening and make sure the new hardware will fit.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.

B. Product data including manufacturer's technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

C. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

a. Type, style, function, size, and finis of each hardware item.
b. Name and manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.
e. Explanation of all abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for hardware.
g. Door and frame sizes and materials.
h. Keying information.
i. System electrical drawing
j. Electrical Elevation for each electrified door showing wire gauge and conductor requirements

2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule

E. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawing of other work to confirm that adequate provision are made for locating and installing door hardware to comply with indicated requirements.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) From a single manufacturer

B. Supplier Qualification: A recognized architectural door hardware supplier, with warehousing facilities within 150 miles of the job site that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced architectural hardware consultant (AHC) who is certified by the Door and Hardware Institute and available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation..

1. Hardware supplier to meet with Owner to finalize keying requirements and to obtain final instructions in writing

2. Hardware supplier is to stock cores and key blanks for the school system. Key Systems that require the factory to re-key cores and provide cut keys is not approved.

C. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to Protect tested by UL, Warnock Hersey, FM, or other testing and inspecting organization acceptable to authorities having jurisdiction for use on types and sizes of door indicated in compliance with requirements of fire-rated door and door frame labels.

D. Door hardware supplier shall provide a written review of all fire rated door assemblies. This review will be conducted by a DHI certified fire door inspector (FDAI) and provided with closeout documents.

E. Integrated Wiegand, Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed through direct factory dealers. Suppliers and Installers are to be factory trained, certified, and a direct purchaser of the specified products and be responsible for commissioning, testing and servicing the installed equipment indicated for the Project.

Automatic Operator Supplier Qualifications: Power operator products and accessories are required to be supplied and installed through current members of the manufacturer's "Power Operator Preferred Installer" program. Suppliers are to be factory trained, certified, and a direct purchaser of the specified power operators.

1.5 PRODUCT HANDLING

A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set number of approved hardware schedule. Two or more identical sets may be packed in same container.

C. Inventory door hardware jointly at the jobsite with representative of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).

F. Provide secure lock-up for door hardware delivered to the project but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

E. Provide a pre-installation meeting with the general contractor reviewing the installation of all hardware.

1.6 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner’s continued adjustment, maintenance, and removal and replacement of door hardware.

B. Provide "as built" electrical, system and point to point wiring diagrams.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include the following:

1. Butts and Continuous Hinges:
   a. Stanley
   b. Hager
   c. Ives
   e. ABH

2. Lock and Latchsets
   a. Best 45H (no substitution)

3. Stops
   a. Rockwood
   b. H.B. Ives Company
   c. Hager

4. Overhead Closers:
   a. Stanley HD8000
   b. LCN 4040XP
   c. Sargent 281

5. Kick, Mop, Armor Plates, Push/Pull Hardware:
   a. Hager
   b. Rockwood
   c. Ives

6. Overhead Stops
   a. Glynn Johnson
   b. ABH
   c. Rixson

7. Exit Devices ,
   a. Precision Apex x US32D
   b. Von Duprin 98 Series

8 . Power Transfers
   a. Von Duprin X EPT10
   b. Securitron X CEPT-10
   c. Stanley x EPT-12C
   d. ABH PT1000

9. Cylinders
   a. Best removable core (No substitution)

2.2 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section. Products are identified by using hardware designation numbers of the following:

1. Manufacturer's Product Designation: The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified under the Article "Manufacturers" in Part 2 for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.

2.3 MATERIALS AND FABRICATION

A. Manufacturer's Name Plate: Do not use manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect.

1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware unit for finish designations indicated.

C. Fastener: provide hardware manufactured to conform to published templated, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

D. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.

2.4 HINGES, BUTTS, AND PIVOTS

A. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

B. Screws: Provide Phillips flat-head screws complying with the following requirements:

1. For metal doors and frames install machine screws into drilled and tapped holes.
2. For wood doors and frames install wood screws.
3. For fire-rated wood doors install #12 x 1 1/4-inch (32mm), threaded-to-the-head steel wood screws.
4. Finish screw heads to match surface of hinges or pivots

C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

1. Out-Swing Exterior Doors: Nonremovable pins.
2. Interior Doors: Nonrising pins.
3. Tips: Flat button and matching plug, finished to match leaves, except where hospital tip (HT) indicated.

D. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges per door leaf for doors 90 inches (2250mm) or less in height and one additional hinge for each 30 inches (750mm) of additional height.

1. Fire-Rated Doors: Not less than 3 hinges per door leaf for doors 86 inches (2150mm) or less in height with same rule for additional hinges.

2.5 LOCK CYLINDERS AND KEYING

All cylinder cores are to be provided by the owner.

2.6 LOCKS, LATCHES, AND BOLTS

A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.

1. Provide flat lip strikes for locks with 3-piece, antifriction latch bolts as recommended by manufacturer.
2. Provide extra long strike lips for locks used on frames with applied wood casing trim.
3. Provide recess type top strikes for bolts locking into head frames, unless otherwise indicated.

B. Lock Throw: Provide 5/8-inch (16mm) minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

1. Provide ½-inch (13mm) minimum throw of latch for other bored and preassembled types of locks and 3/4-inch (19mm) minimum throw of latch for mortise locks. Provide 1-inch (25mm) minimum throw for all dead bolts.

C. Flush Bolt Heads: Minimum of ½-inch (13mm) diameter rods of brass, bronze, or stainless steel with minimum 12-inch (300mm) long rod for doors up to 84 inches (2100mm) in heights. Provide longer rods as necessary for doors exceeding 84 inches (2100mm) in height.

D. Exit Device Dogging: Except on fire-rated doors where closers are provided on doors equipped with exit devices, equip the unit with keyed dogging device to keep the latch bolt retracted, when engaged.

2.7 PUSH/PULL UNITS

A. Exposed Fasteners: Provide manufacturer's standard exposed fasteners for installation, thru-bolted for matched pairs but not for single units.

B. Concealed Fasteners: Provide manufacturer's special concealed fastener system for installation, thru-bolted for matched pairs but not for single units.

2.8 CLOSERS AND DOOR CONTROL DEVICES

A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit depending on size of door, exposure to weather, and anticipated frequency of use.

1. Where parallel arms are indicated for closers, provide closer unit one size larger than recommended for use with standard arms.
2. Provide parallel arms for all overhead closers, except as otherwise indicated.

B. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ANSI A117.1 provisions for door opening force and delayed action closing.

C. Combination Door Closers and Holders: Provide units designed to hold door in open position under normal usage and to release and close door automatically under fire conditions. Incorporate an integral electromagnetic holder mechanism designed for use with UL listed fire detectors, provided with normally closed switching contacts.

2.9 DOOR TRIM UNITS

A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.

B. Fabricate edge trim of stainless steel to fit door thickness in standard lengths or to match height of protection plates.

C. Fabricate protection plates not more than 2 inches less than door width on the push side by the height indicated.

1. Metal Plates: Stainless steel, .050 (U.S. 16 gage) (1.6mm).

2.10 HARDWARE FINISHES

A. Match items to the manufacturer's standard color and texture finish for the latch and lock sets (for push-pull units if no latch or lock sets).

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. The designations used in schedules and elsewhere to indicate hardware finishes are the industry recognized standard commercial finishes, except as otherwise noted.

1. Rust-Resistant Finish: For iron and steel base metal required for exterior work and in areas shown as "High Humidity" areas (and also when designed with the suffix-RR), provide 0.2ml (0.005mm) thick copper coating on base metal before applying brass, bronze, nickel, or chromium plated finishes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount hardware units at heights indicated in following applicable publication, except as specifically indicated or required to comply with governing regulation and except as otherwise directed by Architect.

1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Section. Do not install surface mounted items until finishes have been completed on the substrates involved.

C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealers."

G. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

H. Conduct an electrified hardware coordination meeting with owner, contractor, architect, electrical contractor.

3.2 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

B. Clean adjacent surfaces soiled by hardware installation.

B. Instruct Owner's personnel in proper adjustment and maintenance of door hardware and hardware finishes.

PRODUCT DELIVERY, STORAGE AND HANDLING

A. Acceptance: Upon delivery to the site, Contractor shall inspect all products and materials for any damage. Acceptance of the units constitutes that the inspection has occurred and no damaged or unacceptable products were found, and any damage or unacceptable products would be the responsibility of the Contractor.

WARRANTY

A. All work and system components shall be covered by a one (1) year 'in field' warranty against defects in materials and workmanship, commencing with substantial completion of the project, unless otherwise directed by owner or their representative.

3.4 HARDWARE SCHEDULE

Opening List

Opening	Hdw Heading
101-A	05
101-B	01
101-C	01
101-D	05
101-E	01
101-F	01
102-A	03
102-B	03
106-A	03
106-B	03
107-A	04
108-A	02
108-B	02
109-A	02
109-B	02
111-A	08
113-A	06
113-B	07
114-A	06
116-A	08

Opening	Hdw Heading
117-A	06
118-A	06
119-B	01
119-C	01
119-D	09
119-E	09
202-A	06

Manufacturer List

Code	Name
BE	Best Access Systems
BE01	Best Access Systems
HA	Hager
LC	LCN Closers
NA	National Guard
PREP	Job Note
VO	Von Duprin

Heading #01

1 Other Door #**101-B**
1 Other Door #**101-C**
1 Other Door #**101-E**
1 Other Door #**101-F**
1 Other Door #**119-B**
1 Other Door #**119-C**

R5	6	Note(By Others)	ALL HARDWARE BY DOOR SUPPLIER		PREP

Heading #02

1 Other Door #**108-A**
1 Other Door #**108-B**
1 Other Door #**109-A**
1 Other Door #**109-B**

CORE	4	Note(By Others)	CYLINDER CORE BY OWNER		PREP
MCYL	4	Mortise Cylinder	1E-74 L/C	626	BE

Heading #03

1 Single Door #**102-A**
1 Single Door #**102-B**
1 Single Door #**106-A**
1 Single Door #**106-B**

B02	12	Hinge	BB1279 4 1/2 x 4 1/2 NRP	US26D	HA
L38	4	Lockset	45H-7INL15H L/C VIN	626	BE
CORE	8	Note(By Others)	CYLINDER CORE BY OWNER		PREP
CL2	4	Closer	4040XP SCUSH	AL	LC
KP1	4	Protection Plate	190S 8" x 34"	US32D	HA
G2	4	Gasketing	5050 C-17 17'		NA
ADB1	4	Auto Door Bottom	220 NA 36"		NA

Heading #04

1 Single Door #**107-A**

B01	3	Hinge	BB1279 4 1/2 X 4 1/2	US26D	HA
L65	1	Privacy Set	45H-0L15H VINEO	626	BE01
CL2	1	Closer	4040XP SCUSH	AL	LC
KP1	1	Protection Plate	190S 8" x 34"	US32D	HA

Heading #05

1 Single Door #**101-A**
1 Single Door #**101-D**

CH1	2	Continuous Hinge	780-112HD 83"	CLR	HA
ED10	2	Exit Device	99L x 996L-R&V	US26D	VO
CORE	2	Note(By Others)	CYLINDER CORE BY OWNER		PREP
RCYL	2	Rim Cylinder	12E-72 L/C RP	626	BE
CL2	2	Closer	4040XP SCUSH	AL	LC
KP1	2	Protection Plate	190S 8" x 34"	US32D	HA
G1	2	Gasketing	160 VA 1 x 36" 2 x 84"		NA
RD1	2	Drip Cap	16 A 40"		NA
SW1	2	Door Sweep	200 NA 36"		NA
TH1	2	Saddle Threshold	425 36" PA	AL	NA

Heading #06

1 Single Door #**113-A**
1 Single Door #**114-A**
1 Single Door #**117-A**
1 Single Door #**118-A**
1 Single Door #**202-A**

B02	15	Hinge	BB1279 4 1/2 x 4 1/2 NRP	US26D	HA
L04	5	Lockset	45H-7D15H L/C	626	BE
CORE	5	Note(By Others)	CYLINDER CORE BY OWNER		PREP
CL2	5	Closer	4040XP SCUSH	AL	LC
KP1	5	Protection Plate	190S 8" x 34"	US32D	HA

Heading #07

1 Pair Doors #**113-B**

CH1	2	Continuous Hinge	780-112HD 83"	CLR	HA
FB1	2	Flush Bolt	282D	US26D	HA
L04	1	Lockset	45H-7D15H L/C	626	BE
CORE	1	Note(By Others)	CYLINDER CORE BY OWNER		PREP
CL2	2	Closer	4040XP SCUSH	AL	LC
KP1	2	Protection Plate	190S 8" x 34"	US32D	HA
AST2	1	Astragal	109 NA 84"		NA
G3	1	Gasketing	160 VA 1 x 72" 2 x 84"		NA
RD2	1	Drip Cap	16 A 76"		NA
SW1	2	Door Sweep	200 NA 36"		NA
T2	1	Saddle Threshold	425 72"	AL	NA

Heading #08

1 Single Door #**111-A**
1 Single Door #**116-A**

B02	6	Hinge	BB1279 4 1/2 x 4 1/2 NRP	US26D	HA
L37	2	Lockset	45H-7R15H L/C	626	BE
CORE	2	Note(By Others)	CYLINDER CORE BY OWNER		PREP
CL2	2	Closer	4040XP SCUSH	AL	LC
KP1	2	Protection Plate	190S 8" x 34"	US32D	HA

Heading #09

1 Pair Doors #**119-D**
1 Pair Doors #**119-E**

CH1	4	Continuous Hinge	780-112HD 83"	CLR	HA
RM1	2	Steel Mullion	KR4954 7'6"	SP28	VO
ED10	4	Exit Device	99L x 996L-R&V	US26D	VO
CORE	6	Note(By Others)	CYLINDER CORE BY OWNER		PREP
MCYL	2	Mortise Cylinder	1E-74 L/C	626	BE
RCYL	4	Rim Cylinder	12E-72 L/C RP	626	BE
CL2	4	Closer	4040XP SCUSH	AL	LC
KP1	4	Protection Plate	190S 8" x 34"	US32D	HA
AST	2	Gasketing	600 A (SET) 84"		NA
G3	2	Gasketing	160 VA 1 x 72" 2 x 84"		NA
RD2	2	Drip Cap	16 A 76"		NA
SW1	4	Door Sweep	200 NA 36"		NA
T2	2	Saddle Threshold	425 72"	AL	NA

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For glass.

C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.11 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Drawings.

a. Wind Design Data: As indicated on Drawings.

2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Guardian Glass LLC.
b. Pilkington North America; NSG Group.
c. Saint-Gobain Glass Corp.
d. Vitro Architectural Glass.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

C. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Guardian Glass LLC.
b. Pilkington North America; NSG Group.
c. Saint-Gobain Glass Corp.
d. Vitro Architectural Glass.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. EPDM with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. EPDM with Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

A. Clear Glass Type: Fully tempered float glass.

1. Minimum Thickness: 6 mm.
2. Safety glazing required.

3.9 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Glass Type (for Exterior Applications):

1. Basis-of-Design Product: Vitro Solarban 60
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Fully tempered float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Fully tempered float glass.
7. Low-E Coating: Sputtered on second surface.
8. Winter Nighttime U-Factor: 0.29 maximum.
9. Summer Daytime U-Factor: 0.27 maximum.
10. Visible Light Transmittance: 70 percent minimum.
11. SGHC: 0.39 maximum.
12. Safety glazing required.

B. Clear Insulating Glass Type (for Interior Applications):

1. Overall Unit Thickness: 1 inch.
2. Minimum Thickness of Each Glass Lite: 6 mm.
3. Outdoor Lite: Fully tempered float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Fully tempered float glass.
6. Winter Nighttime U-Factor: 0.45 maximum.
7. Summer Daytime U-Factor: 0.47 maximum.
8. Visible Light Transmittance: 70 percent minimum.
9. SGHC: 0.71 maximum.
10. Safety glazing required.

END OF SECTION 08 80 00

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing systems.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Framing systems.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation Reports: For firestop tracks post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, the Steel Stud Manufacturers Association, or the Supreme Steel Framing System Association.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, in accordance with ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

C. Horizontal Deflection: For composite and non-composite wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 5 lbf/sq. ft..

D. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.

E. Design Loads: 5 lbf/sq. ft. minimum as required by the IBC.

F. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with AISI S220 and ASTM C645, Section 10 for conditions indicated.

1. Steel Sheet Components: Comply with AISI S220 and ASTM C645, Section 10 requirements for metal unless otherwise indicated
2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.

    a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

B. Studs and Track: AISI S220 and ASTM C645, Section 10.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CEMCO; California Expanded Metal Products Co.
    b. ClarkDietrich.
    c. Custom Stud.
    d. Jaimes Industries.
    e. MBA Building Supplies.
    f. MRI Steel Framing, LLC.
    g. Phillips Manufacturing Co.
    h. SCAFCO Steel Stud Company; Stone Group of Companies.

2. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection.
3. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide the following:

1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width required.

1. Minimum Base-Steel Thickness: 0.0296 inch.

F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As required by performance requirements for horizontal deflection..
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels:

1. Minimum Base-Steel Thickness: 0.0329 inch.
2. Depth: As indicated on Drawings.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLATION OF FRAMING SYSTEMS

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
2. Multilayer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
3. Tile Backing Panels: As required by horizontal deflection performance requirements unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb unless otherwise indicated.
b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

E. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:

1. Section 09 22 16 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
2. Section 09 30 13 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

2.3 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.4 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed; SAINT-GOBAIN.
b. Continental Building Products Inc.
c. Georgia-Pacific Gypsum LLC.
d. Gold Bond Building Products, LLC provided by National Gypsum Company.
e. USG Corporation.

2. Thickness: 5/8 inch.
3. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed; SAINT-GOBAIN.
b. Continental Building Products Inc.
c. Georgia-Pacific Gypsum LLC.
d. Gold Bond Building Products, LLC provided by National Gypsum Company.
e. USG Corporation.

2. Thickness: 5/8 inch.
3. Long Edges: Tapered.

2.5 SPECIALTY GYPSUM BOARD

A. Glass-Mat Interior Gypsum Board: ASTM C1658/C1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed; SAINT-GOBAIN.
b. Continental Building Products Inc.
c. Georgia-Pacific Gypsum LLC.
d. Gold Bond Building Products, LLC provided by National Gypsum Company.
e. USG Corporation.

2. Core: 5/8 inch, Type X or 5/8 inch, abuse resistant as indicated.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blanket Insulation:

1. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing) consisting of fibers; complying with ASTM E136 for combustion characteristics.

E. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: Vertical surfaces unless otherwise indicated.
2. Type X: Where required for fire-resistance-rated assembly.
3. Glass-Mat Interior Type: Shower soffits and restrooms where indicated.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 INSTALLATION OF TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints in accordance with ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated on Drawings.
4. U-Bead: Use at exposed panel edges.

3.6 FINISHING OF GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

4. Level 5: Where indicated and at all exposed Glass-Mat Interior Gypsum Board locations.

    a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical panels.
2. Metal suspension system.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Acoustical panels.
2. Metal suspension system.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.
4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.
    f. Access panels.
    g. Perimeter moldings.

7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
8. Minimum Drawing Scale: 1/4 inch = 1 foot.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Ceiling System: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A in accordance with ASTM E1264.
2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Ceiling & Wall Solutions; Ultima Beveled Tegular, 1911 or a comparable product by one of the following:

1. CertainTeed; SAINT-GOBAIN.
2. USG Corporation.

B. Acoustical Panel Standard: Provide manufacturer's standard panels in accordance with ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide panels as follows:

1. Type and Form: Type IV, Form 2
2. Pattern: E (lightly textured).

D. Color: White.

E. Light Reflectance (LR): Not less than 0.85.

F. Ceiling Attenuation Class (CAC): Not less than 35.

G. Noise Reduction Coefficient (NRC): Not less than 0.75.

H. Edge/Joint Detail: Beveled Tegular.

I. Thickness:

1. 3/4 inch.

J. Modular Size: 24 by 24 inches.

K. Anti-Mold / Mildew: Resists the growth of mold and mildew on the panel surface.

L. Humidity / Sag Resistance: Panels recommended for areas subject to high humidity.

2.4 METAL SUSPENSION SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Ceiling & Wall Solutions; 15/16” Prelude XL or a comparable product by one of the following:

1. CertainTeed; SAINT-GOBAIN.
2. USG Corporation.

B. Wide-Face, Aluminum-Capped, Double-Web, Hot-Dip Galvanized, G60 (Z180), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized, G60 coating designation; with prefinished, 15/16-inch- wide aluminum caps on flanges.

1. Structural Classification: Heavy-duty system.
2. Face Design: Flat, flush.
3. Cap Finish: Painted to match color of acoustical unit.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Stainless Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.135-inch-diameter wire.

C. Hold-Down Clips: Manufacturer's standard hold-down.

1. Provide within 10 feet of all exterior doors and entrances.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF ACOUSTICAL PANEL CEILINGS

A. Install acoustical panel ceilings in accordance with ASTM C636/C636M and manufacturer's written instructions.

1. Fire-Rated Assembly: Install fire-rated ceiling systems in accordance with tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. Arrange directionally patterned acoustical panels as follows:

a. As indicated on reflected ceiling plans.

2. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
4. Install hold-down clips in areas indicated; space in accordance with panel manufacturer's written instructions unless otherwise indicated.

   a. Hold-Down Clips: Space 24 inches o.c. on all cross runners.

5. Protect lighting fixtures and air ducts in accordance with requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Thermoplastic-rubber base.
2. Rubber molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

E. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials , from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F , in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F .

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE [RB]

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexco.
2. Johnsonite; a Tarkett company.
3. Roppe Corporation.

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

1. Group: I (solid, homogeneous) .
2. Style and Location:
   a. Style B, Cove: Provide in areas with resilient floor coverings and carpet .

C. Thickness: 0.125 inch .

D. Height: As indicated on Drawings.

E. Lengths: Coils in manufacturer's standard length .

F. Outside Corners: Job formed .

G. Inside Corners: Job formed .

H. Colors: As selected by Architect from manufacturers full range. Refer to finish schedules on construction documents .

2.2 RUBBER MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexco.
2. Johnsonite; a Tarkett Company.
3. Roppe Corporation.

B. Description: Rubber reducer strip for resilient floor covering transition strips .

1. Profile and Dimensions: Refer to transistion schedule on construction documents .
2. Locations: Provide rubber molding accessories in areas indicated .
3. Colors and Patterns: Color shall coordinate with rubber stair treads and rubber base.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

C. Metal Edge Strips: Extruded aluminum with mill finish , nominal 2 inches wide, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, exposed tube steel columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
   a. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
   a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from resilient stair treads before applying liquid floor polish. Install per manufacturers written recommendations.

E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. High performance luxury vinyl tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient floor tile.

1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples: Full-size units of each color, texture, and pattern of floor tile required.

D. Samples for Initial Selection: For each type of floor tile indicated.

E. Samples for Verification: Full-size units of each color and pattern of floor tile required.

F. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials , from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F , in spaces to receive floor tile during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F .

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 HIGH PERFORMANCE LUXURY VINYL TILE (RF)

A. Manufacturers:

1. Patcraft, Mark Making
2. Interface, Brushed Lines - Basis of design
3. Mohawk Group, Hot & Heavy, Lineate

B. Tile Standard: ASTM F 1700, Class 3, printed vinyl plank.B. Tile Standard: ASTM F 1700, Class 3, printed vinyl plank.

C. Thickness: 4.5 mm minimum.

D. Wear Layer: 22 mil minimum.

E. Backing Class: Commercial Grade.

F. Finish: Ceramor or equal.

G. Size: 25cm x 1m (9.845in by 39.38 in).

H. Installation and Color: As shown on drawings and color schedule.

I. Static Load Limit: ASTM F970, 1500 PSI minimum.

J. Slip Resistance: ASTM D2047, >0.55 wet/dry, ADA compliant.

K. Resistance to Light: ASTM F1515.

L. Resistance to Chemicals: ASTM F925.

M. Indoor Air Quality: Floorscore® certified.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated .

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles as recommended by flooring manufacturer .
   a. Luxury Vinyl Tile: Refer to drawings for patterns and locations.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel Substrates.
2. Galvanized-Metal Substrates
3. Concrete Masonry Units (CMU)

B. Related Requirements:

1. Section 05 12 00 "Structural Steel Framing" for shop priming of metal substrates.
2. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.
3. Section 09 96 00 "High-Performance Coatings" for tilelike coatings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Sustainable Design Submittals:

1. Product Data: For paints and coatings, indicating VOC content.
2. Environmental Product Declaration (EPD): For each product.
3. Health Product Declaration (HPD): For each product.
4. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
5. Manufacturer Inventory: For each product, provide manufacturer's manifest of ingredients.

C. Samples: For each type of topcoat product.

D. Samples for Initial Selection: For each type of topcoat product.

E. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.

4. Label each Sample for location and application area.

F. Product Schedule: Use same designations indicated on Drawings and in the Exterior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
2. VOC content.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
   b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. PPG Paints; PPG Industries, Inc.
3. Sherwin-Williams Company (The).

B. Source Limitations: Obtain each paint product from single source from single manufacturer.

C. Products: Subject to compliance with requirements, provide product listed in the Exterior Painting Schedule for the paint category indicated.

2.2 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.

B. VOC Content: For field applications, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Dry-Fog Coatings: 150 g/L.
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Shellacs, Pigmented: 550 g/L.
6. Shellacs, Clear: 730 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
9. Rust-Preventive Coatings: 100 g/L.

C. Colors: As selected by Architect from manufacturer's full range. Refer to color schedule on architecture drawings for additional information.

D. Products in subsequent articles are specified by reference to MPI categories. Retaining requirements for VOC content or Environmental Performance Rating (EPR) further limits product selection; coordinate selections with products of manufacturers retained in "Manufacturers" Article.

E. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:
   a. Acrolein.
   b. Acrylontrile.
   c. Antimony.
   d. Benzene.
   e. Butyl benzylphthalate.
   f. Cadmium.
   g. Di (2-ethylhexyl) phthalate.
   h. Di-n-butyl phthalate.
   i. Di-n-octyl phthalate.
   j. 1,2-dichlorobenzene.
   k. Diethyl phthalate.
   l. Dimethyl phthalate.
   m. Ethylbenzene.
   n. Formaldehyde.
   o. Hexavalent chromium.
   p. Isophorone.
   q. Lead.
   r. Mercury.
   s. Methyl ethyl ketone.
   t. Methyl isobutyl ketone.
   u. Methylene chloride.
   v. Naphthalene.
   w. Toluene (methylbenzene).
   x. 1,1,1-trichloroethane.
   y. Vinyl chloride.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove

noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and Concrete Masonry Units): 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems specified in this Section.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer .

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in the Exterior Painting Schedule may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.
7. Paint all exposed structural steel and metal on exterior of building, including lintels, hollow metal doors and frames, gates, handrails, etc.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed to view:

a. Equipment,including panelboards and switch gear.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.
h. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
i. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
j. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
k. Electrical equipment and cabinets that is indicated to have a factory-primed finish for field painting.
l. All exposed exterior galvanized lintels.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance with product requirements
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove

noncomplying- paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.6 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.7 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Alkyd (over Alkyd primer) System: MPI EXT 5.1D
   a. Prime coat: Alkyd metal primer (MPI #79).
   b. Intermediate Coat: Alkyd (MPI #94).
   c. Top Coat: Alkyd (MPI #94).

B. Galvanized-Metal Substrates:

1. Alkyd System: MPI EXT 5.3B
   a. Prime Coat: Cementitious Primer (MPI #26).
   b. Interim Coat: Alkyd (MPI #93).
   c. Top Coat: Alkyd (MPI #94).

C. Concrete/Concrete Block Substrates:

1. Institutional Low-Odor/VOC Latex System (Over Latex Block Filler): MPI EXT 4.2A
   a. Prime Coat: Block Filler, Latex, Exterior (MPI# 4)
   b. Interim Coat: Latex (MPI #15)
   c. Top Coat: Latex (MPI #15)

END OF SECTION 09 91 13

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Concrete.
2. Concrete masonry units (CMUs).
3. Steel.
4. Galvanized metal.
5. Gypsum board.

B. Related Requirements:

1. Section 05 12 13 "Architecturally Exposed Structural Steel Framing" for shop priming structural steel.
2. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.
3. Section 05 51 13 "Metal Pan Stairs" for shop priming metal pan stairs.
4. Section 08 11 13 "Hollow Metal Doors and Frames" for shop priming metal doors and frames.
5. Section 09 96 00 "High-Performance Coatings" for tile-like coatings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.
3. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
2. VOC content.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
   b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Akzo Nobel Paints.
2. Benjamin Moore & Co.
3. PPG Paints; PPG Industries, Inc.
4. Pratt & Lambert; a subsidiary of The Sherwin-Williams Company.
5. Sherwin-Williams Company (The).

B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. VOC Content: For field applications that are inside the weatherproofing system, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Dry-Fog Coatings: 150 g/L.
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Shellacs, Pigmented: 550 g/L.
6. Shellacs, Clear: 730 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
9. Rust-Preventive Coatings: 100 g/L.

C. Low-Emitting Materials: For field applications that are inside the weatherproofing system, verify 90 percent of paints and coatings comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Colors: As indicated in a color schedule.

1. Determine percent of surface area that will be painted with deep tones by referencing schedule at end of this section and drawings.

E. Chemical components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compoinds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:
    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzene.
    e. Butyl benzyl phthalate.
    f. Cadmium.
    g. Di (2-ethylhexyl) phthalate.
    h. Di-n-butyl phthalate.
    i. Di-n-octyl phthalate.
    j. 1,2-dichlorobenzene.
    k. Diethyl phthalate.
    l. Dimethyl phthalate.
    m. Ethylbenzene.
    n. Formaldehyde.
    o. Hexavalent chromium.

p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.
3. Gypsum Board: 12 percent.
4. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
6. Paint all exposed structural steel and metal on exterior of building, including lintels, hollow metal doors and frames, gates, handrails, etc.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms and in occupied spaces, but not limited to the following:
   a. Equipment, including panelboards and switch gear.
   b. Uninsulated metal piping.
   c. Uninsulated plastic piping.
   d. Pipe hangers and supports.
   e. Metal conduit.
   f. Plastic conduit.
   g. Tanks that do not have factory-applied final finishes.
   h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   i. Mechanical equipment that is indicated to have a factory-primed finish for field painting..
   j. Electrical equipment that is indicated to have a factory primed finish for field painting.
2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Traffic Surfaces:

1. Solvent-Based Concrete Floor Sealer System, MPI INT 3.2F:
   a. First Coat: Sealer, solvent based, for concrete floors, matching topcoat.
   b. Topcoat: Sealer, solvent based, for concrete floors, MPI #104.

      1) H&C Products Group, Clarishield, Solvent Based Natural Look Clear Concrete sealer, Or Equal.

B. CMU Substrates:

1. Institutional Low-Odor/VOC Latex System MPI INT 4.2E:
   a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
   b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
   c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.
   d. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss satin (MPI Gloss Level 4), MPI #147.
2. Epoxy System: MPI INT 4.2F [Wash Bay, Janitor, Maintenance, Maintenance Office, Mechanic's Bay, Wash Station, Restrooms and showers]
   a. Prime Coat: Interior/exterior latex block filler (MPI #4).
   b. Intermediate Coat: Epoxy, matching topcoat (MPI #77).
   c. Topcoat: Epoxy, gloss (MPI#77).

C. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System MPI INT 5.1S:
   a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
   b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
   c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 4), MPI #147 .
2. Water-Based Dry-Fall System MPI INT 5.1C :
   a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76. OR .
   b. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79. .
   c. Prime Coat: Shop primer specified in Section where substrate is specified.
   d. Topcoat: Dry fall, latex, flat, MPI #118.
3. Water-Based Dry Fall over Shop-Applied Quick-Drying Shop Primer System MPI INT 5.1CCC :
   a. Prime Coat: Primer, quick dry, for shop application, MPI #275.
   b. Topcoat: Dry fall, latex, flat, MPI #118. .
   c. Topcoat: Dry fall, water based, for galvanized steel, flat (MPI Gloss Level 1), MPI #133.

D. Galvanized-Metal Substrates [Including interior lintels]:

1. Institutional Low-Odor/VOC Latex System MPI INT 5.3N :
    a. Prime Coat: Primer, galvanized, water based, MPI #134.
    b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
    c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss satin (MPI Gloss Level 4), MPI #147. .
2. Water-Based Dry-Fall System MPI INT 5.3H :
    a. Prime Coat: Dry fall, water based, for galvanized steel, matching topcoat.
    b. Topcoat: Dry fall, water based, for galvanized steel, flat (MPI GlossLevel 1), MPI #133.

E. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System MPI INT 9.2M :
    a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
    b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
    c. Topcoat: Latex, interior, institutional low odor/VOC (MPI GlossLevel 3), MPI #145 [Soffits and Ceilings]. .
    d. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss satin (MPI Gloss Level 4), MPI #147.
2. Epoxy, Water-Based System: MPI INT 9.2E [Maintenance, Mechanic's Bay, Maintenance Office, Storage, Bus Garage, Janitor, Mezzanine, Restrooms and showers].
    a. Prime Coat: Latex primer sealer (MPI #50).
    b. Intermediate Coat: Epoxy matching topcoat (MPI #77).
    c. Topcoat: Epoxy, gloss (MPI #77).

END OF SECTION 09 91 23

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Interior Substrates:
   a. Steel.

B. Related Requirements:

1. Section 05 12 13 "Architecturally Exposed Structural Steel Framing" for shop priming of structural steel with primers specified in this Section.
2. Section 09 91 13 "Exterior Painting" for general field painting.
3. Section 09 91 23 "Interior Painting" for general field painting.

1.3 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
   a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
   b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. MDC.
3. PPG Paints; PPG Industries, Inc.
4. Scuffmaster.
5. Sherwin-Williams Company (The).

6. Zolatone (Basis of Design).

B. Products: Subject to compliance with requirements, provide product listed in the Exterior High-Performance Coating Schedule or Interior High-Performance Coating Schedule for the coating category indicated.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

C. VOC Content: For field applications, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Primers, Sealers, and Undercoaters: 100 g/L.
4. Rust-Preventive Coatings: 100 g/L.
5. Shellacs, Pigmented: 550 g/L.
6. Shellacs, Clear: 730 g/L.
7. Floor Coatings: 50 g/L.
8. Pretreatment Wash Primers: 420 g/L.
9. Zinc-Rich Industrial Maintenance Primers: 100 g/L.

D. Low-Emitting Materials: For field applications that are inside the weatherproofing system, verify 90 percent of paints and coatings comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Colors: As selected by Architect from manufacturer's full range (exterior) As indicated in color schedule (interior).

2.3 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

1. Pigmented Polyurethane over High-Build Epoxy System MPI INT 5.1G [Doors, Trim, Stairs & Handrails]
   a. Prime Coat: Primer, epoxy, anti-corrosive, for metal. [MPI #108]
   b. Intermediate Coat: Pigmented polyurethane, interior, matching topcoat..
   c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 5), MPI #174.
2. High Performance Architectural Latex System MPI INT 5.1RR [Wash Bay Structural Columns]
   a. Prime Coat: Alkyd Anti-Corrosive primer, semi-gloss finish (MPI gloss level 5) MPI #79
   b. Intermediate Coat: HIPAC Latex MPI #141, matching topcoat.
   c. Topcoat: HIPAC Latex, semi-gloss finish (MPI gloss level 5) MPI #141

END OF SECTION 09 96 00

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dimensional characters.

a. Cast dimensional characters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design sign structure and anchorage of dimensional character sign type(s) according to structural performance requirements.

B. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.

1. Uniform Wind Load: As indicated on Drawings.
2. Concentrated Horizontal Load: As indicated on Drawings.
3. Other Design Load: As indicated on Drawings
4. Uniform and concentrated loads need not be assumed to act concurrently.

2.2 DIMENSIONAL CHARACTERS

A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A.R.K. Ramos.
b. ANDCO Industries Corp.
c. ASI Sign Systems, Inc.
d. Ellet Sign Company
e. Gemini Signage; Gemini, Inc.
f. VOMAR Products Inc.

2. Character Material: Cast aluminum.
3. Character Height: As indicated on Drawings.
4. Thickness: Minimum 3/8”

5. Finishes:
    a. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.

6. Mounting: Projecting studs.
7. Typeface: To Be Selected by Architect.

2.3 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless steel devices unless otherwise indicated.
3. Sign Mounting Fasteners:

    a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

B. Adhesive: As recommended by sign manufacturer.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

B. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DIMENSIONAL CHARACTERS

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 19

SECTION 10 14 23.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes room-identification signs that are directly attached to the building.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements , including raised characters and Braille, and layout for each sign at least half size .
4. Provide location plan for all sign types.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Room-Identification Signs: Full-size Sample .
2. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
3. Exposed Accessories: Full-size Sample of each accessory type.
4. Full-size Samples, if approved, will be returned to Contractor for use in Project.

E. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Templates: Provide template for sign inset for future use.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.10 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Deterioration of finishes beyond normal weathering.
   b. Deterioration of embedded graphic image.
   c. Separation or delamination of sheet materials and components.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1 .

2.2 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign : Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ASI Sign Systems, Inc.
   b. Ellet Sign.
   c. Interior Graphic Systems.
   d. Sign Force.

e. Take Form.

2. Laminated-Sheet Sign: Acrylic face sheet with raised graphics laminated over subsurface graphics to acrylic backing sheet to produce composite sheet.
   a. Composite-Sheet Thickness: Manufacturer's standard for size of sign .
   b. Subsurface Graphics: Back painted with slide in changeable insert .
   c. Color(s): As selected by Architect from manufacturer's full range .
3. Sign-Panel Perimeter: Finish edges smooth.
   a. Edge Condition at Vertical Edges at Horizontal Edges : Square cut .
   b. Corner Condition in Elevation: Square .
4. Mounting: Surface mounted to wall with countersunk flathead through fasteners .
5. Text and Typeface: Accessible raised characters and Braille. Type face as selected by Architect from manufacturer's full range and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color. .

2.3 SIGN MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

D. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:
   a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.
   b. Fastener Heads: Use flathead screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.
4. Sign Mounting Fasteners:
   a. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.

3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

C. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:

1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Subsequent changeable inserts are by Owner .
2. For frame to hold changeable sign panel, fabricate frame without burrs or constrictions that inhibit function. Furnish initial sign panel.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls as indicated on drawings and according to the accessibility standard. .

C. Mounting Methods:

1. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
2. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

3.2 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 23.16

SECTION 10 21 13.17 - PHENOLIC-CORE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments.

B. Related Requirements:
1. Section 06 10 00 "Rough Carpentry" for blocking.
2. Section 09 22 16 "Non-Structural Metal Framing" for blocking.
3. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

1.2 COORDINATION

A. Coordinate requirements for blocking, reinforcing, and other supports concealed within wall to ensure that toilet compartments can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

A. Product Data.

1. Phenolic-core toilet compartments.

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment.

1. Include Samples of hardware and accessories involving material and color selection.

D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

E. Delegated Design Submittals: For grab bars mounted on toilet compartment panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For toilet compartments.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hinges: One hinge(s) with associated fasteners.
2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.
3. Door Bumper: One door bumper(s) with associated fasteners.
4. Door Pull: One door pull(s) with associated fasteners.
5. Fasteners: 10 fasteners of each size and type.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain phenolic-core toilet compartments from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 75 or less.
2. Smoke-Developed Index: 450 or less.

B. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:

1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf applied at any direction and at any point, without deformation of panel.

C. Regulatory Requirements: Comply with applicable provisions in ICC A117.1 for toilet compartments designated as accessible.

2.3 PHENOLIC-CORE TOILET COMPARTMENTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASI Global Partitions.
2. Bradley Corporation.
3. Scranton Products
4. Hadrian Solutions ULC

B. Toilet-Enclosure Style: Overhead braced, Floor anchored.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, and Pilaster Construction: Solid phenolic-core material with melamine facing on both sides fused to substrate during manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch-thick doors and pilasters and minimum 1/2-inch-thick panels.

E. Urinal-Screen Construction: Matching panel construction.

F. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

G. Pilaster Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

H. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design, stainless steel.

I. Phenolic Compartment Finish: One color in each room.

1. Through-Color Phenolic: Manufacturer's standard solid through-color.

a. Color: As selected by Architect from manufacturer's full range.

2.4 HARDWARE AND ACCESSORIES

A. Door Hardware and Accessories, Heavy Duty: Manufacturer's heavy-duty institutional operating hardware and accessories.

1. Hinges: Manufacturer's minimum 0.062-inch-thick, stainless-steel surface-mounted, paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door. Mount with through bolts.
2. Latch and Keeper: Manufacturer's heavy-duty, surface-mounted, cast stainless steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible. Mount with through bolts.
3. Coat Hook: Manufacturer's heavy-duty, combination cast stainless steel hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories. Mount with through bolts.
4. Door Bumper: Manufacturer's heavy-duty, rubber-tipped, cast stainless steel bumper at outswinging doors. Mount with through bolts.
5. Door Pull: Manufacturer's heavy-duty, cast stainless steel pull at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible. Mount with through bolts.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.5 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221.

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

D. Stainless Steel Castings: ASTM A743/A743M.

2.6 FABRICATION

A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Floor-Anchored Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

D. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide, inswinging doors for standard toilet enclosures and 36-inch-wide, outswinging doors with a minimum 32-inch-wide, clear opening for toilet enclosures designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels or Screens: 1/2 inch.
b. Panels or Screens and Walls: 1 inch.

2. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13.17

SECTION 10 22 13 – WIRE MESH PARTITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Heavy-duty wire mesh partitions.

1.2 DEFINITIONS

A. Intermediate Crimp: Wires pass over one and under the next adjacent wire in both directions, with wires crimped before weaving and with extra crimps between the intersections.

B. Lock Crimp: Deep crimps at points of the intersection that lock wires securely in place.

1.3 ACTION SUBMITTALS

A. Product Data:

   1. Wire mesh partitions.

B. Shop Drawings:

   1. Include plans, elevations, sections, and attachment details.
   2. Indicate clearances required for operation of doors.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for units with factory-applied color finishes.

D. Samples for Verification: Panel constructed of specified frame members and wire mesh. Show method of finishing members at intersections.

   1. Size: 12 by 12 inches (300 by 300 mm).

E. Delegated Design Submittals: For wire mesh partitions indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates:

   1. Welding certificates.

B. Qualification Statements: For Installer.

C. Delegated design engineer qualifications.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wire mesh partition hardware.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Locks: Furnish no fewer than 2 locks.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Installers: Fabricator of products or Authorized representative who is trained and approved by manufacturer.
2. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

a. AWS D1.1/D1.1M.
b. AWS D1.3/D1.3M.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire mesh items with cardboard protectors on perimeters of panels and doors and with posts wrapped to provide protection during transit and Project-site storage. Use vented plastic.

B. Inventory wire mesh partition door hardware on receipt, and provide secure lockup for wire mesh partition door hardware delivered to Project site.

1. Tag each item or package separately with identification, and include basic installation instructions with each item or package.

C. Deliver keys to Owner by registered mail or overnight package service.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with wire mesh units by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wire Crafters Style-840-Woven-Wire-Partitions-and-Enclosures (Basis of Design)
B. Cisco-Eagle
C. Saferack
D. Acorn

2.2 SOURCE LIMITATIONS

A. For wire mesh products, obtain each color, grade, finish, type, and variety from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wire mesh units.

B. Structural Performance: Wire mesh units to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m) at any location on a panel.
2. Total load of 200 lbf (0.89 kN)] <Insert value> applied uniformly over each panel.
3. Concentrated load and total load need not be assumed to act concurrently.

C. Regulatory Requirements: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC A117.1 for doors and gates designated as accessible.

2.4 HEAVY-DUTY WIRE MESH PARTITIONS

A. Mesh:

1. 0.192-inch- (4.9-mm-) diameter, intermediate-crimp steel wire woven into 2-inch (50-mm) diamond mesh.
2. 0.192-inch- (4.9-mm-) diameter steel wire, resistance welded into 1-1/2-by-2-1/2-inch (38-mm-by-65-mm) rectangular mesh.

B. Vertical and Horizontal Panel Framing: 1-1/2-by-3/4-by-1/8-inch (38-by-19-by-3.2-mm) cold-rolled steel channels; with holes for 3/8-inch- (9.5-mm-) diameter bolts not more than 12 inches (300 mm) o.c.

C. Horizontal Panel Stiffeners: Two cold-rolled steel channels, 1 by 1/2 by 1/8 inch (25 by 13 by 3.2 mm), bolted or riveted toe to toe through mesh.

D. Top Capping Bars: 3-by-1-inch (76-by-25-mm) steel channels.

E. Posts for 90-Degree Corners: 1-1/2-by-1-1/2-by-1/8-inch (38-by-38-by-3.2-mm) steel angles or tubes or 2-by-2-by-0.075-inch (50-by-50-by-1.9-mm) cold-rolled steel angles or tubes, with holes for 3/8-inch- (9.5-mm-) diameter bolts aligning with bolt holes in vertical framing; with 1/4-inch (6.4-mm) steel base plates.

F. Line Posts: 3-inch-by-4.1-lb (76-mm-by-1.9-kg) or 3-1/2-by-1-1/4-by-1/8-inch (89-by-32-by-3.2-mm) steel channels; with 1/4-inch (6.4-mm) steel base plates.

G. Floor Shoes: Metal, not less than 2 inches (50 mm) high; sized to suit vertical framing, drilled for attachment to floor, and with setscrews for leveling adjustment.

H. Swinging Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/2-by-3/4-by-1/8-inch (38-by-19-by-3.2-mm) steel channels, banded with 1-1/2-by-1/8-inch (38-by-3.2-mm) flat steel bar cover plates on four sides, and with 1/8-inch- (3.2-mm-) thick angle strike bar and cover on strike jamb.

1. Hinges: Full-surface type, 3-1/2-by-3-1/2-inch (89-by-89-mm) steel, three per door; bolted, riveted, or welded to door and jamb framing.
2. Padlock Lug: Mortised into door framing and enclosed with steel cover.

I. Accessories:

1. Sheet Metal Base: 0.060-inch- (1.5-mm-) thick, steel sheet.
2. Adjustable Filler Panels: 0.060-inch- (1.5-mm-) thick, steel sheet; capable of filling openings from 2 to 12 inches (50 to 300 mm).
3. Wall Clips: Manufacturer's standard, cold-rolled steel sheet[; allowing up to 1 inch (25 mm) of adjustment.

J. Finish: Powder-coated finish unless otherwise indicated.

1. Color: As selected by Architect from manufacturer's full range.

2.5 MATERIALS

A. Steel Wire: ASTM A510/A510M.

B. Steel Plates, Channels, Angles, and Bars: ASTM A36/A36M.

C. Steel Sheet: Cold-rolled steel sheet, ASTM A1008/A1008M, Commercial Steel (CS), Type B.

D. Steel Pipe: ASTM A53/A53M, Schedule 40, unless another weight is indicated or required by structural loads.

E. Steel Tubing: ASTM A500/A500M, cold-formed structural-steel tubing or ASTM A513/A513M, Type 5, mandrel-drawn mechanical tubing.

F. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.

G. Panel-to-Panel Fasteners: Manufacturer's standard steel bolts, nuts, and washers.

H. Post-Installed Anchors: Capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components are zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

I. Power-Driven Fasteners: ICC-ES AC70.

J. Shop Primers: Provide primers that comply with Section 09 91 23 "Painting."

K. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer, complying with MPI#79.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

L. Zinc-Rich Primer: Compatible with topcoat, complying with SSPC-Paint 20 or SSPC-Paint 29.

M. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2.6 FABRICATION

A. General: Fabricate wire mesh items from components of sizes not less than those indicated. Use larger-sized components as recommended by wire mesh item manufacturer. Furnish bolts, hardware, and accessories required for complete installation with manufacturer's standard finishes.

1. Fabricate wire mesh items to be readily disassembled.
2. Welding: Weld corner joints of framing and grind smooth, leaving no evidence of joint.

B. Heavy-Duty Wire Mesh Partitions: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.

1. Mesh: Securely clinch or Weld mesh to framing.
2. Framing: Fabricate framing with mortise-and-tenon corner construction.

a. Provide horizontal stiffeners as indicated or, if not indicated, as required by panel height and as recommended by wire mesh partition manufacturer. Weld horizontal stiffeners to vertical framing.
b. Fabricate partition and door framing with slotted holes for connecting adjacent panels.

3. Fabricate wire mesh partitions with 3 to 4 inches (75 to 100 mm) of clear space between finished floor and bottom horizontal framing.
4. Fabricate wire mesh partitions with bottom horizontal framing flush with finished floor.
5. Doors: Align bottom of door with bottom of adjacent panels.

a. For doors that do not extend full height of partition, provide transom over door, fabricated from same mesh and framing as partition panels.

6. Hardware Preparation: Mortise, reinforce, drill, and tap doors and framing as required to install hardware.

C. Wire Mesh Ceilings: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.

1. Mesh: Securely clinch or Weld mesh to framing.
2. Framing: Fabricate framing with mortise-and-tenon or welded corner construction.

a. Provide stiffeners as indicated or, if not indicated, as required by panel span and as recommended by wire mesh ceiling manufacturer. Weld stiffeners to framing.

D. Wire Mesh Stairway Partitions: Provide door jamb framing on each side of doors. Attach tamper shields centered behind exit devices.

2.7 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean items of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Preparation for Shop Priming: Prepare surfaces to comply with [SSPC-SP 6/NACE No. 3,

D. Shop Priming: Apply shop primer to uncoated surfaces of wire mesh units unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

E. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on powder-coat finish, suitable for use indicated, with a minimum dry film thickness of 2 mils (0.05 mm).

1. As selected by Architect from manufacturer's full range .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine floors for suitable conditions where wire mesh items will be installed.

C. Examine walls to which wire mesh items will be attached for properly located blocking, grounds, and other solid backing for attachment of support fasteners.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF WIRE MESH PARTITIONS

A. Anchor wire mesh partitions to floor with 3/8-inch- (9.5-mm-) diameter, postinstalled expansion anchors at 12 inches (300 mm) o.c. through anchor clips located at each post and corner. Shim anchor clips as required to achieve level and plumb installation.

1. Anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if indicated on Shop Drawings.

B. Anchor wire mesh partitions to floor with 3/8-inch- (9.5-mm-) diameter, postinstalled expansion anchors at 12 inches (305 mm) o.c. through floor shoes located at each post and corner. Adjust wire mesh partition posts in floor shoes to achieve level and plumb installation.

1. Anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if indicated on Shop Drawings.

C. Anchor wire mesh partitions to walls at 12 inches (305 mm) o.c. through back corner panel framing and as follows:

1. For concrete and solid masonry anchorage, use expansion anchors.

D. Secure top capping bars to top framing channels with 1/4-inch- (6-mm-) diameter, "U" bolts spaced not more than 28 inches (700 mm) o.c.

E. Provide line posts at locations indicated or, if not indicated, as follows:

F. Where standard-width wire mesh partition panels do not fill entire length of run, provide adjustable filler panels to fill openings.

G. Install doors complete with door hardware.

H. Install service windows complete with window hardware.

I. Weld or bolt sheet metal bases to wire mesh partitions and doors where indicated.

J. Bolt accessories to wire mesh partition framing.

3.3 REPAIR

A. Repair Painting:

1. Wire brush and clean rust spots, welds, and abraded areas immediately after installation, and apply repair paint with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

2. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

3.4 ADJUSTING

A. Adjust doors to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly. Verify that latches and locks engage accurately and securely without forcing or binding.

3.5 PROTECTION

A. Remove and replace defective work, including doors and framing that are warped, bowed, or otherwise unacceptable.

END OF SECTION 10 22 13

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Custodial accessories.

1.2 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Materials: Sanitary Vendor (SV-1), Soap dispensers (SD-1), paper towel dispenser (PT-1), toilet tissue roll dispenser (TP-1), and sanitary disposal units (SDU-1). Owner provided, contractor installed.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf (1112 N) concentrated load applied in any direction and at any point.
2. Shower Seats: Installed units are able to resist 250 lbf (1112 N) applied in any direction and at any point.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

B. Grab Bar [GB-X] :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ASI American Specialties, Inc.; ASI Group.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
   a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
4. Outside Diameter: 1-1/4 inches .
5. Configuration and Length: As indicated on Drawings Straight, with lengths as follows: .
   a. GB-1: 36" wide
   b. GB-2: 42" wide
   c. GB-3: 18" wide

C. Mirror Unit [M-X] :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ASI American Specialties, Inc.; ASI Group.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.
2. Frame: Stainless steel angle, 0.05 inch thick .
   a. Corners: Welded and ground smooth.
3. Size: As indicated below.
   a. M-1: 24" wide x 60" high
   b. M-2: 18" wide x 36" high
4. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below .
   a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
   b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

D. Hook [CH-1] :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ASI American Specialties, Inc.; ASI Group.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.
2. Description: Single-prong unit .
3. Mounting: Concealed .
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin) .

2.4 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

B. Custodial Mop and Broom Holder [MH-1] :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ASI American Specialties, Inc.; ASI Group.
   b. Bobrick Washroom Equipment, Inc.[Basis of Design]
   c. Bradley Corporation.
2. Description: Unit with holders.
3. Length: 24 inches .
4. Mop/Broom Holders: Three spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.5 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.

B. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

C. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

D. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

E. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 10 28 00

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:

a. Portable fire extinguisher.

B. Related Requirements:

1. Section 10 44 16 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.2 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire-protection cabinets, including, but not limited to, the following:

a. Schedules and coordination requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed, semirecessed, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.3 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Basis-of-Design Product: Subject to compliance with requirements, provide J. L. Industries, Inc.; Activar Construction Products Group, Inc.; Cosmopolitan or a comparable product by one of the following:

a. Babcock-Davis.
b. Larsen's Manufacturing Company.
c. Modern Metal Products.
d. Nystrom, Inc.

B. Cabinet Construction: Nonrated or One-hour fire rated where required.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Stainless steel sheet.

1. Shelf: Same metal and finish as cabinet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

1. Rolled-Edge Trim.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Stainless steel sheet.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide recessed door pull and friction latch.
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Accessories:

1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet door.
2) Application Process: Decals.
3) Lettering Color: Red.
4) Orientation: Vertical.

K. Materials:

1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304.

a. Finish: ASTM A480/A480M No. 4 directional satin finish.

2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.4 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Miter corners and grind smooth.
3. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at height indicated below:

1. Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
2. Provide inside latch and lock for break-glass panels.
3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
4. Fire-Rated Cabinets:

    a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
    b. Seal through penetrations with firestopping sealant as specified in Section 07 84 13 "Penetration Firestopping."

C. Identification:

1. Apply decals at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements:

1. Section 10 44 13 "Fire Protection Cabinets."

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:

a. Schedules and coordination requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide J. L. Industries, Inc.; Activar Construction Products Group, Inc.; Cosmic Multipurpose Dry Chemical ABC or a comparable product by one of the following:

a. Babcock-Davis.
b. Guardian Fire Equipment, Inc.
c. Larsen's Manufacturing Company.
d. Nystrom, Inc.

2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
3. Valves: Manufacturer's standard.
4. Handles and Levers: Manufacturer's standard.
5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 3-A:40-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

1. Mounting Height: Top of fire extinguisher to be at 42 inches above finished floor.

END OF SECTION 10 44 16

SECTION 10 51 13 - METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Welded, open-front athletic lockers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.

B. Shop Drawings: For metal lockers.

   1. Include plans, elevations, sections, and attachment details.
   2. Show locker trim and accessories.
   3. Include locker identification system and numbering sequence.

C. Samples: For each color specified, in manufacturer's standard size.

D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.

E. Samples for Verification: For the following products, in manufacturer's standard size:

   1. Lockers and equipment.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. The following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:

    a. Locks.
    b. Blank identification plates.
    c. Hooks.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures.
    b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Welded Metal Lockers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain metal lockers, locker benches, and accessories from single source from single locker manufacturer.

1. Obtain locks from single lock manufacturer.

2.2 WELDED, OPEN-FRONT ATHLETIC LOCKERS

A. Manufacturers
    1. List Industries Inc.
    2. Lyon LLC.
    3. Penco Products, Inc.
    4. Republic Storage Systems, LLC.

B. Expanded-Metal Doors: Fabricated from 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.105-inch (2.66-mm) nominal-thickness steel angle frame; with 0.090-inch (2.28-mm) nominal-thickness, steel sheet lock panel backed by 0.060-inch (1.52-mm) nominal-thickness, steel sheet retainer welded to door frame.

C. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops and Bottoms: 0.060-inch (1.52-mm) nominal thickness, with single bend at edges.
2. Backs: 0.048-inch (1.21-mm) nominal thickness.
3. Shelves: 0.060-inch (1.52-mm) nominal thickness, with double bend at front and single bend at sides and back.

D. Unperforated Sides: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

E. Expanded-Metal Sides: Fabricated from 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.105-inch (2.66-mm) nominal-thickness steel angles or 0.060-inch (1.52-mm) nominal-thickness steel channel frames.

F. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet or 0.097-inch (2.45-mm) nominal-thickness steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

1. Cross Frames for Double-Tier Lockers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
2. Cross Frames for Triple-Tier Lockers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.

G. Reinforced Bottoms: Structural channels, formed from 0.060-inch (1.52-mm) nominal-thickness steel sheet; welded to front and rear of side-panel frames.

H. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9 mm) high.

I. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.

J. Coat Rods: 1-inch- (25-mm-) diameter steel, chrome finished

K. Continuous Zee Base: 4 inches (102 mm) high; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet.

L. Continuous Sloping Tops: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

1. Closures: Vertical -end type.

M. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

N. Filler Panels: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

O. Boxed End Panels: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.

P. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

Q. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.
3. Expanded Metal: ASTM F1267, Type II (flattened), Class I (uncoated), 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.

R. Finish: Baked enamel or powder coat.

1. Color: As selected by Architect from manufacturer's full range.

2.3 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Equipment: Provide each locker with an identification plate and the following equipment:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
3. Triple-Tier Units: One double-prong ceiling hook.
4. Open-Front Athletic Lockers: Two single-prong wall hooks bolted to locker back and coat rod.

D. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.

E. Continuous Zee Base: Fabricated in lengths as long as practical to enclose base and base ends; finished to match lockers.

F. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

G. Individual Sloping Tops: Fabricated in width to fit one locker frame in lieu of flat locker tops; with integral back; finished to match lockers. Provide wedge-shaped divider panels between lockers.

H. Recess Trim: Fabricated with minimum 2-1/2-inch (64-mm) face width and in lengths as long as practical; finished to match lockers.

I. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

J. Boxed End Panels: Fabricated with 1-inch- (25-mm-) wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

K. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

L. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.4 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
3. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Lockers: Assemble with manufacturer's standard fasteners, with no exposed fasteners on door faces or face frames.

C. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.

D. Equipment:

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

    a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
    b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

E. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach recess trim to recessed metal lockers with concealed clips.
2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
3. Attach sloping-top units to metal lockers, with closures at exposed ends.
4. Attach boxed end panels using concealed fasteners to conceal exposed ends of nonrecessed metal lockers.
5. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 10 51 13

SECTION 10 73 16.13 – METAL CANOPIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Canopies:
   1. Hangar supported.

1.2 RELATED SECTIONS

A. Section 04 20 00 - Unit Masonry.
B. Section 09 91 13 - Exterior Painting. Paint finish on framing members.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data:
   1. Manufacturer's data sheets and technical specifications for each product to be used.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Typical installation methods.

C. Color Verification Samples: Two representative units of each color.

D. Shop Drawings: Include details of materials, construction, and finish. Include relationship with adjacent construction.
   1. Show structural component locations/positions, material dimensions and details of construction and assembly.

E. PE Stamped calculations are required and must be signed and sealed by an engineer licensed within the state canopy is installed.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum of five years documented experience.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

1.1 DELIVERY, STORAGE, AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

B. Protect from damage due to weather, excessive temperature, and construction operations.

C. Deliver materials in manufacturer's original protective coverings and packaging with corresponding labels and identifying information.

D. Protect materials against damage during transit, delivery, storage, and installation at site. Protect against bending, warping, twisting or surface damage. Store in accordance with manufacturers written instructions and in a dry location.

E. Inspect materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.

1.1 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.1 WARRANTY

A. Manufacturer's standard limited warranty unless indicated otherwise.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. CANOPIES; HANGAR SUPPORTED

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Mapes Super Lumideck (Basis of Design)
   2. Skyscape Architectural Canopies
   3. BOK Modern, Inc.

2.2 Materials

A. Decking shall consist of 3" extruded flat soffit .078 decking.

B. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown in current Mapes brochures.

C. Hanger rods and attachment hardware shall be a standard finish.

D. Fascia shall be standard extruded 8" J style.

2.3 Finishes

A. Finish type shall be 2-Coat Kynar Finish

.

2.4 Fabrication

A. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.

B. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to Downspout From Rear Gutter.

Part 3: Execution

3.1 Inspection

A. Confirm that surrounding area is ready for the canopy installation.
B. Installer shall confirm dimensions and elevations to be as shown on drawings provided by Mapes Industries.
C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed

3.2 Installation

A. Installation shall be in strict accordance with manufacturer's shop drawings. Particular attention should be given to protecting the finish during handling and erection.

3.3 Cleaning

A. Remove protective film from exposed metal surfaces.

B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with

C. manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage the material or finish.

SECTION 12 32 16 - MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad casework.
2. Casework hardware and accessories.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood blocking for anchoring casework.
2. Section 09 22 16 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring casework.
3. Section 09 65 13 "Resilient Base and Accessories" for resilient base applied to plastic-laminate-clad casework.
4. Section 12 36 61.16 "Solid Surfacing Countertops" for solid surface counters, worksurfaces and transaction counters

1.2 DEFINITIONS

A. Definitions in the AWI/AWMAC/WI's "Architectural Woodwork Standards" apply to the Work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

B. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying requirements.

1.4 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that casework can be supported and installed as indicated.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plastic-laminate-clad casework.

1. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.
2. Indicate types and sizes of casework.
3. Indicate manufacturer's catalog numbers for casework.
4. Show fabrication details, including types and locations of hardware.
5. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and equipment.
6. Apply AWI's Quality Certification Program label to Shop Drawings.

C. Keying Schedule: Include schematic keying diagram, and index each key set to unique designations that are coordinated with the Contract Documents.

D. Samples: For casework and hardware finishes.

E. Samples for Initial Selection: For casework and hardware finishes.

F. Samples for Verification: For the following:

1. Plastic Laminates: 8 by 10 inches , for each type, color, pattern, and surface finish required.
   a. Provide one Sample applied to core material with specified edge material applied to one edge.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For casework manufacturer and Installer.

B. Sample Warranty: For special warranty.

C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI's Quality Certification Program certificates.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer and Licensed participate in AWI's Quality Certification Program.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

B. Deliver casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during remainder of construction period. Maintain temperature and relative humidity during remainder of construction period in range recommended for Project location by the AWI/AWMAC/WI's "Architectural Woodwork Standards."

B. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

C. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Delamination of components or other failures of glue bond.
   b. Warping of components.
   c. Failure of operating hardware.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Southern Cabinetry.
2. Stevens Industries, Inc.
3. TMI Systems Corporation.
4. Top Craft.

B. Source Limitations: Obtain from single source from single manufacturer.

2.2 GENERAL REQUIREMENTS FOR CASEWORK

A. Quality Standard: Unless otherwise indicated, comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.

1. Grade: Custom .

B. Product Designations:

1. Drawings indicate sizes, configurations, and finish materials of manufactured plastic-laminate-clad casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish materials, and complying with the Specifications may be considered. See Section 01 60 00 "Product Requirements."

2.3 PLASTIC-LAMINATE-CLAD CASEWORK

A. Design: Frameless cabinet construction with the following door and drawer-front style:

1. Flush overlay.

B. Grain Direction for Wood-Grain Plastic Laminate:

1. Doors: Vertical with continuous vertical matching.
2. Drawer Fronts: Vertical with continuous vertical matching .
3. Face Frame Members: Lengthwise.
4. End Panels: Vertical.

5. Bottoms and Tops of Units: Side to side.
6. Knee Space Panels: Vertical.
7. Aprons: Horizontal.

C. Exposed Materials:

1. Plastic-Laminate Grade: HGS .
   a. Colors and Patterns: As selected by Architect from manufacturer's full range .

D. Semiexposed Materials:

1. Plastic Laminate: Grade VGS unless otherwise indicated. Provide plastic laminate for semiexposed surfaces unless otherwise indicated.
   a. Colors and Patterns: As selected by Architect from Manufacturers full range.
   b. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.
2. Hardboard: Use only for cabinet backs where exterior side of back is not exposed.
3. Unless otherwise indicated, provide specified edgebanding on all semiexposed edges.

E. Concealed Materials:

1. Solid Wood: With no defects affecting strength or utility.
2. Plywood: Hardwood plywood.
3. Plastic Laminate: Grade BKL.
4. Particleboard.
5. MDF.
6. Hardboard.

2.4 CASEWORK HARDWARE AND ACCESSORIES

A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware.

1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.

B. Butt Hinges: Stainless steel , semiconcealed, five-knuckle hinges complying with ANSI/BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two hinges for doors less than 48 inches high, and provide three hinges for doors more than 48 inches high.

C. Wire Pulls: Solid stainless steel wire pulls, fastened from back with two screws.

1. Provide two pulls for drawers more than 24 inches wide.

D. Door Catches: Zinc-plated , nylon-roller spring catch or dual, self-aligning, permanent magnet catch. Provide two catches on doors more than 48 inches high.

E. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.

1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.
2. Drawers: Provide one bumper on back side of drawer front at each corner.

F. Drawer Slides: ANSI/BHMA A156.9.

1. Heavy Duty (Grade 1HD-100): Side mount .
    a. Type: Full extension.
    b. Material: Zinc-plated steel slides.
    c. Steel Ball-bearing slides.
2. Box Drawer Slides: Grade 1HD-100, for drawers not more than 6 inches (150 mm) high and 24 inches (600 mm) wide.
3. File Drawer Slides: Grade 1HD-200, for drawers more than 6 inches (150 mm) high or 24 inches (600 mm) wide.

G. Label Holders: Stainless steel , sized to receive standard label cards approximately 1 by 2 inches, and attached with screws or brads.

1. Provide label holders where indicated .

H. Drawer and Hinged-Door Locks: Cylindrical (cam) type, five-pin tumbler, brass with chrome-plated finish, and complying with ANSI/BHMA A156.11, Grade 1.

1. Provide a minimum of two keys per lock and six master keys.
2. Key rooms alike, unless directed otherwise by owner. Provide a separate key number for each room.
    a. Medicine cabinet in clinic shall be keyed separately from all other cabinets, and on a separate master.
3. Provide locks on every door and drawer.

I. Adjustable Shelf Supports

1. Adjustable Shelf Supports: Pin-type, two-pin-locking plastic shelf rests complying with ANSI/BHMA A156.9, Type B04013 .
2. Adjustable Shelf Supports: Mortise-type, zinc-plated steel standards and shelf rests complying with ANSI/BHMA A156.9, Type B04071 and Type B04091.

J. Chain Stops: Zinc plated, looped chain with mounting plates at each end of chain used to limit door swing. Provide at all doors adjacent to a wall or other obstruction. Chain Stop shall allow door to open a minimum of 100 degrees.

2.5 MATERIALS

A. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.

B. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated.

C. Softwood Plywood: DOC PS 1.

D. Particleboard: ANSI A208.1, Grade M-2.

E. MDF: Medium-density fiberboard, ANSI A208.2, Grade 130 .

F. Hardboard: ANSI A135.4, Class 1 tempered.

G. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.

H. PVC Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3.0 mm thick at doors and drawer fronts, 1.0 mm thick elsewhere.

I. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 FABRICATION

A. Plastic-Laminate-Clad Cabinet Construction: As required by referenced quality standard, but not less than the following:

1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard.
2. Shelves: 3/4-inch- thick plywood or 1-inch- thick particleboard.
3. Backs of Casework: 1/2-inch- thick particleboard or MDF where exposed, 1/4-inch-thick, veneer-core hardwood plywood dadoed into sides, bottoms, and tops where not exposed.
4. Drawer Fronts: 3/4-inch particleboard.
5. Drawer Sides and Backs: 1/2-inch- thick solid-wood or veneer-core hardwood plywood,particleboard or MDF, with glued dovetail or multiple-dowel joints.
6. Drawer Bottoms: 1/4-inch- thick hardwood plywood of glued and dadoed into front, back, and sides of drawers. Use 1/2-inch material for drawers more than 24 inches wide.
7. Doors 48 Inches High or Less: 3/4 inch thick, with particleboard or MDF cores and solid-wood stiles and rails.
8. Doors More Than 48 Inches High: 1-1/8 inches thick, with particleboard cores.

B. Filler Strips: Provide as needed to close spaces between casework and walls, ceilings, and equipment. Fabricate from same material and with same finish as casework. Fillers shall extend the full depth of cabinet to create a flush surface on top and/or bottom of case. FIller finish shall match adjacent casework.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Grade: Install casework to comply with same quality standard grade as item to be installed.

B. Install casework level, plumb, and true in line; shim as required using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

1. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish or toggle bolts through metal backing or metal framing behind wall finish.

C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Align similar adjoining doors and drawers to a tolerance of 1/16 inch. Bolt adjacent cabinets together with joints flush, tight, and uniform.

D. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten cabinets to hanging strips, masonry, framing, wood blocking, or reinforcements in walls and partitions. Align similar adjoining doors to a tolerance of 1/16 inch.

E. Fasten casework to adjacent units and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards."

F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

G. Adjust operating hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

H. Provide clear sealant all casework sides where adjacent to walls.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

3.4 CLEANING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 12 32 16

SECTION 12 36 61.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Corian [Basis of Design]
   b. DuPont; DuPont de Nemours, Inc.
   c. Formica Corporation.
   d. Wilsonart LLC.
2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Colors and Patterns: As selected by Architect from manufacturer's full range. Refer to color schedule on architectural drawings.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom .

B. Countertops:

1. 1/2-inch- thick, solid surface material .

C. Backsplashes: 1/2-inch- thick, solid surface material.

D. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

E. Joints:

1. Fabricate countertops in sections for joining in field.
   a. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.

F. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
   a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

1. Verify adhesives have a VOC content of 70 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of

Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

H. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION 12 36 61.16

SECTION 13 34 19 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structural-steel framing.
   2. Metal roof panels.
   3. Metal wall panels.
   4. Thermal insulation.
   5. Accessories.

B. Related Requirements:
   1. Section 07 72 53 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface.
   2. Section 08 11 13 “Hollow Metal Doors and Frames” for doors in metal building systems.
   3. Section 08 36 13 "Sectional Doors" for sectional vehicular doors in metal building systems.

1.2 DEFINITIONS

A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.3 COORDINATION

A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."

B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to metal building systems including, but not limited to, the following:

      a. Condition of foundations and other preparatory work performed by other trades.
      b. Structural load limitations.
      c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
      d. Required tests, inspections, and certifications.
      e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.

2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:

    a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
    b. Structural limitations of purlins and rafters during and after roofing.
    c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
    d. Temporary protection requirements for metal roof panel assembly during and after installation.
    e. Roof observation and repair after metal roof panel installation.
3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:

    a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
    b. Structural limitations of girts and columns during and after wall panel installation.
    c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
    d. Temporary protection requirements for metal wall panel assembly during and after installation.
    e. Wall observation and repair after metal wall panel installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

    a. Metal roof panels.
    b. Metal wall panels.
    c. Thermal insulation and vapor-retarder facings.

B. PEMB submittals shall be submitted in early January 2026.

C. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:
1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.

    a. Show provisions for attaching roof curbs.
3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

    a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
    b. Show wall-mounted items including personnel doors, vehicular doors, windows, louvers, lighting fixtures, canopies, and signage.

4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:

    a. Flashing and trim.
    b. Gutters.
    c. Downspouts.

D. Samples for Initial Selection: For units with factory-applied finishes.

E. Delegated Design Submittals: For metal building systems.
1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For erector and manufacturer.

B. Welding certificates.

C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
1. Name and location of Project.
2. Order number.
3. Name of manufacturer.
4. Name of Contractor.
5. Building dimensions including width, length, height, and roof slope.
6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
7. Governing building code and year of edition.
8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
10. Building-Use Category: Indicate category of building use and its effect on load importance factors.

D. Erector Certificates: For qualified erector, from manufacturer.

E. Material Test Reports: For each of the following products:
1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

F. Source quality-control reports.

G. Field quality-control reports.

H. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.

I. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panel finishes to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.
   1. Accreditation: Manufacturer's facility accredited according to IAS AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
   2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.3, "Structural Welding Code - Sheet Steel."

D. Land Surveyor Qualifications: A professional land surveyor who practices in jurisdiction where Project is located and who is experienced in providing surveying services of the kind indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect foam-plastic insulation as follows:
   1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
   3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Paint Systems:
      a. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
         1) Color fading more than 5 Hunter units when tested according to ASTM D2244.
         2) Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
         3) Cracking, checking, peeling, or failure of paint to adhere to bare metal.
      b. Finish Warranty Period - PVDF: 30 years from date of Substantial Completion.
      c. Finish Warranty Period – Siliconized Polyester: 25 years from date of Substantial Completion.
   2. Galvalume systems:
      a. Warranty Period: 20 years from date of Substantial Completion.

B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
   1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Buildings Company; a Nucor company.
   2. Bigbee Steel Buildings, Inc.
   3. Chief Buildings; Chief Industries, Inc.
   4. Nucor Building Systems; a Nucor company.
   5. Iron City Structures, LLC.

B. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

B. Primary-Frame Type:
   1. Rigid Modular: Solid-member, structural-framing system with interior columns.

C. End-Wall Framing:
   1. Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns.
   2. Engineer end walls to be expandable, where indicated in drawings. Provide primary frame, capable of supporting full-bay design loads, and end-wall columns.

D. Secondary-Frame Type: Manufacturer's standard purlins and joists and exterior-framed (bypass) girts.

E. Eave Height: As indicated in Drawings.

F. Bay Spacing: As indicated in Drawings.

G. Roof Slope: As indicated in Drawings.

H. Roof System: Manufacturer's standard mechanically seamed trapezoidal standing-seam, metal roof panels with concealed cli
   1. Liner Panels: Tapered rib.

I. Exterior Wall System: Manufacturer's standard exposed-fastener, tapered-rib, metal wall panels.
   1. Liner Panels: Tapered rib.

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design metal building system.

B. Structural Performance: Metal building systems to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
   1. Design Loads: As indicated on Drawings.
   2. Deflection and Drift Limits:

      a. Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
      b. As indicated on Drawings, but not greater than the following:

         1) Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Fire-Resistance Ratings: Where assemblies are indicated to have a fire-resistance rating, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E119 or ASTM E108 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory," FM Global's "Approval Guide," or from the listings of another qualified testing agency.

E. Fire Propagation Characteristics: Exterior wall assemblies containing foam plastics pass NFPA 285 fire test.

F. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

G. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
1. Wind Loads: As indicated on Drawings.

H. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
1. Test-Pressure Difference: 1.57 lbf/sq. ft..

I. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
1. Test-Pressure Difference: 1.57 lbf/sq. ft..

J. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: 2.86 lbf/sq. ft..

K. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: 2.86 lbf/sq. ft..

L. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
1. Uplift Rating: As indicated on Drawings, or if not otherwise indicated: UL 90.

M. Thermal Performance for Opaque Elements: Provide the following maximum U-factors and minimum R-values when tested according to ASTM C1363 or ASTM C518:
1. Roof:

a. U-Factor: 0.0299.
b. R-Value: R-30 + R-8

1) 10” Z purlin (R-30)
2) 1” EPS spacer block + Continuous Insulation (R-8)

2. Walls:

a. U-Factor: 0.059.
b. R-Value: R-25.

1) 8” Z girt.

2.4 STRUCTURAL-STEEL FRAMING

A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."

B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."

C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
   1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

      a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
   2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
   3. Exterior Column: Tapered.
   4. Rafter: Uniform depth or Tapered.

E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
   1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
   2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
   1. Purlins:

      a. C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch-wide flanges.

         1) Depth: 8” or as otherwise indicated on Drawings.
   2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch-wide flanges.

      a. Depth: 10” or as otherwise indicated on Drawings.
   3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
   4. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch-diameter, cold-formed structural tubing to stiffen primary-frame flanges.
   5. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
   6. Base or Sill Angles: Manufacturer's standard base angle, minimum 3-by-2-inch, fabricated from zinc-coated (galvanized) steel sheet.
   7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
   8. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
   9. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

G. Bracing: Provide adjustable wind bracing using any method as follows:

1. Rods: ASTM A36/A36M; ASTM A572/A572M, Grade 50; or ASTM A529/A529M, Grade 50; minimum 1/2-inch-diameter steel; threaded full length or threaded a minimum of 6 inches at each end.
2. Cable: ASTM A475, minimum 1/4-inch-diameter, extra-high-strength grade, Class B, zinc-coated, seven-strand steel; with threaded end anchors.
3. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
4. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
5. Fixed-Base Columns: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
6. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.

H. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.

I. Materials:
1. W-Shapes: ASTM A992/A992M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
3. Plate and Bar: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
4. Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.
5. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B or C, structural tubing.
6. Structural-Steel Sheet: Hot-rolled, ASTM A1011/A1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70; or cold-rolled, ASTM A1008/A1008M, Structural Steel (SS), Grades 25 through 80, or HSLAS, Grades 45 through 70.
7. Metallic-Coated Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G60 coating designation; mill phosphatized.
8. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.

    a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G90 coating designation.
    b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, SS, Grade 50 or 80; with Class AZ50 coating.
9. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A, carbon-steel, hex-head bolts; ASTM A563 carbon-steel hex nuts; and ASTM F844 plain (flat) steel washers.

    a. Finish: Hot-dip zinc coating, ASTM F2329, Class C.
10. High-Strength Bolts, Nuts, and Washers, Grade A325: ASTM F3125/F3125M, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

    a. Finish: Hot-dip zinc coating, ASTM F2329, Class C.
11. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1 hardened carbon-steel washers.

a. Finish: Mechanically deposited zinc coating, ASTM B695, Class 50.

12. Unheaded Anchor Rods: ASTM F1554, Grade 36.

    a. Configuration: Straight.
    b. Nuts: ASTM A563 heavy-hex carbon steel.
    c. Plate Washers: ASTM A36/A36M carbon steel.
    d. Washers: ASTM F436 hardened carbon steel.
    e. Finish: Hot-dip zinc coating, ASTM F2329, Class C.

13. Headed Anchor Rods: ASTM F1554, Grade 36.

    a. Configuration: Straight.
    b. Nuts: ASTM A563 heavy-hex carbon steel.
    c. Plate Washers: ASTM A36/A36M carbon steel.
    d. Washers: ASTM F436 hardened carbon steel.
    e. Finish: Hot-dip zinc coating, ASTM F2329, Class C.

14. Threaded Rods: ASTM A307, Grade A.

    a. Nuts: ASTM A563 heavy-hex carbon steel.
    b. Washers: ASTM A36/A36M carbon steel.
    c. Finish: Hot-dip zinc coating, ASTM F2329, Class C.

J. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
   1. Clean and prepare in accordance with SSPC-SP2.
   2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.

      a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

2.5 METAL ROOF PANELS

A. Metal Roof Panels: Mechanically seamed trapezoidal standing seam roof panel with concealed clips. Installed directly over purlins. Tested in accordance with ASTM E 1646 and E 1680 for water penetration and air infiltration, and per ASTM E1592 for wind uplift capacity.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Nucor Building Systems; CFR Roof Panel, or a comparable product.
      a. Metal thickness options in "Material" Subparagraph below correspond to obsolete 26, 24, and 22 gages, respectively.
      b. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, min. 0.024-inch nominal uncoated steel thickness.
         1) Exterior Finish: Galvalume
      c. Clips: Two-piece floating to accommodate thermal movement.
      d. Joint Type: Mechanically seamed.
      e. Panel Coverage: 24 inches.
      f. Panel Height: 3 inches.

B. Exposed-Fastener, Tapered-Rib, Metal Liner Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
   1. Basis-of-Design Product [For use in Wash Bay]: Subject to compliance with requirements, provide Nucor Building Systems; R-Panel Wall Panel, or a comparable product.
      a. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, min. 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

1) Exterior Finish: Siliconized Polyester Resin.
2) Color: As selected by Architect from manufacturer's full range, or as indicated in the Drawings.

b. Major-Rib Spacing: 12 inches o.c.
c. Panel Coverage: 36 inches.
d. Panel Height: 1.25 inches.
e. Weathertight Installation.

C. Finishes:
1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
b. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a minimum dry film thickness of 0.2 mil for primer and 0.8 mil for topcoat.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.6 METAL WALL PANELS

A. Exposed-Fastener, Tapered-Rib, Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Nucor Building Systems; R-Panel Wall Panel, or a comparable product.
a. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, min. 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
1) Exterior Finish: Two-coat fluoropolymer.
2) Color: As selected by Architect from manufacturer's full range, or as indicated in the Drawings.
b. Major-Rib Spacing: 12 inches o.c.
c. Panel Coverage: 36 inches.
d. Panel Height: 1.25 inches.

B. Tapered-Rib, Metal Liner Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
1. Basis-of-Design Product [For use in Wash Bay]: Subject to compliance with requirements, provide Nucor Building Systems; R-Panel Wall Panel, or a comparable product.
a. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, min. 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
1) Exterior Finish: Two-coat fluoropolymer.
2) Color: As selected by Architect from manufacturer's full range, or as indicated in the Drawings.
b. Major-Rib Spacing: 12 inches o.c.
c. Panel Coverage: 36 inches.
d. Panel Height: 1.25 inches.

e. Weathertight Installation.

2. Basis-of-Design Product [For use at all other locations]: Subject to compliance with requirements, provide Nucor Building Systems; R-Panel Liner Panel, or a comparable product.
   a. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, min. 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
      1) Exterior Finish: Siliconized Polyester Resin.
      2) Color: Polar White
   b. Major-Rib Spacing: 12 inches o.c.
   c. Panel Coverage: 36 inches.
   d. Panel Height: 1.25 inches.
3.

C. Finishes:
   1. Exposed Coil-Coated Finish:

      a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.7 THERMAL INSULATION

A. Basis-of-Design Product: Subject to compliance with requirements, provide Silvercote, A distribution international company; Energy Saver or comparable product by another manufacturer.

B. Wall Insulation System: Energy Saver Single Layer – Full Cavity – no visible girts.

C. Roof Insulation System: Energy Saver FP Liner System – Full Cavity – no visible purlins.

D. Unfaced Metal Building Insulation: ASTM C991, Type I, or NAIMA 202, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch-wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.

E. Retainer Strips: For securing insulation between supports, 0.025-inch nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.

F. Vapor-Retarder Facing: ASTM C1136, with permeance not greater than 0.02 perm when tested according to ASTM E96/E96M, Desiccant Method.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Silvercote, A distribution international company; Energy Saver Fabric or comparable product by another manufacturer.
   2. Composition:

      a. Woven reinforced high-density polyethylene, coated both sides with polyethylene coating.
      b. Weave: Woven HPDE Scrim
      c. Coating: 2.0 mil
      d. Color: White
      e. Weight: 4.4 oz/sq.yd.
      f. Thickness: 9 mil nominal

G. Thermal Block: Minimum R-3 thermal spacer blocks are required.

H. Energy Saver Patch Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

I. Energy Saver Adhesive: High shear and high tack adhesive to bond fabric to steel framing

J. Energy Saver Thermal Tape: Applied to outer secondary steel to reduce heat transfer.

K. Energy Saver Banding: Support for Energy Saver Insulation components.

L. Energy Saver Banding Clips: Reduces number of fasteners required for installation of Energy Saver Components.

M. Insul-Hold: Used to support insulation in the wall girt cavity.

N. OSHA-compliant leading edge fall protection.

2.8 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
   1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
   2. Clips: Manufacturer's standard, formed from stainless steel sheet, designed to withstand negative-load requirements.
   3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from stainless steel sheet or nylon-coated aluminum sheet.
   4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
   6. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch standoff; fabricated from extruded polystyrene.

C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.
   1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
   2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

E. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
   1. Gutter Supports: Fabricated from same material and finish as gutters.
   2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.

F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot-long sections, complete with formed elbows and offsets.
   1. Mounting Straps: Fabricated from same material and finish as gutters.

G. Roof Curbs: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.048-inch nominal uncoated steel thickness prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.
   1. Curb Subframing: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.060-inch nominal uncoated steel thickness, angle-, C-, or Z-shaped metallic-coated steel sheet.
   2. Insulation: 1-inch-thick, rigid type.

H. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

I. Materials:
   1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
   2. Fasteners for Metal Roof Panels:
      a. Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless steel cap or zinc-aluminum-alloy head and EPDM sealing washer.
      b. Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.
   3. Fasteners for Metal Wall Panels:
      a. Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with EPDM sealing washers bearing on weather side of metal panels.

4. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
5. Blind Fasteners: High-strength aluminum or stainless steel rivets.
6. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
7. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
8. Metal Panel Sealants:

    a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
    b. Joint Sealant: ASTM C920; one part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.9 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.
1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members to be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
1. Make shop connections by welding or by using high-strength bolts.
2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
1. Make shop connections by welding or by using non-high-strength bolts.
2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.10 SOURCE QUALITY CONTROL

A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports.
   1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.

      a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
   1. Engage land surveyor to perform surveying.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written instructions and drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
   1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.

      a. Joint Type: Snug tightened or pretensioned as required by manufacturer.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
   1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
   2. Locate and space wall girts to suit openings such as doors and windows.
   3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
   1. Tighten rod and cable bracing to avoid sag.
   2. Locate interior end-bay bracing only where indicated.

I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
   1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.

C. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

      a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
   2. Install metal panels perpendicular to structural supports unless otherwise indicated.
   3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Locate metal panel splices over structural supports with end laps in alignment.
   6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

D. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
   1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

E. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

F. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
   1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
   2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
   1. Install ridge caps as metal roof panel work proceeds.
   2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
   1. Install clips to supports with self-drilling or self-tapping fasteners.
   2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
   3. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
   4. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.

5. Provide metal closures at peaks, rake edges, rake walls, and each side of ridge caps.

C. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
   1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
   2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
   3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
   4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

E. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
   2. Shim or otherwise plumb substrates receiving metal wall panels.
   3. When two rows of metal panels are required, lap panels 4 inches minimum.
   4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
   5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
   6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
   7. Install screw fasteners in predrilled holes.
   8. Install flashing and trim as metal wall panel work proceeds.
   9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
   10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
   11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, noncumulative; level, plumb, and on location lines; and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 THERMAL INSULATION INSTALLATION

A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.
   1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
   2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
   3. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.

B. Blanket Roof Insulation: Comply with the following installation method:
   1. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation full depth between purlins. Install vapor-retarder fabric and banding continuous over bottom of purlin. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.

      a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
   2. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

C. Blanket Wall Insulation: Extend insulation full depth of girts. Install vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
   1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
   2. Thermal Tape: Install thermal tape at exterior face each wall girt.

3.8 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24

inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
   1. Provide elbows at base of downspouts to direct water away from building.
   2. Tie downspouts to underground drainage system indicated.

E. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.

F. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.9 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.

B. Product will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 ADJUSTING

A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.

B. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.

C. Windows: Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and at weather stripping to ensure smooth operation and weathertight closure. Lubricate hardware and moving parts.

D. Louvers: After completing installation, including work by other trades, lubricate, test, and adjust units to operate easily, free of warp, twist, or distortion as needed to provide fully functioning units.
   1. Adjust louver blades to be weathertight when in closed position.

3.11 CLEANING AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Touchup Painting:
   1. After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.

      a. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
      b. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
   2. Cleaning and touchup painting are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

D. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
   1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

E. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.
   1. Immediately before final inspection, remove protective wrappings from doors and frames.

F. Windows: Clean metal surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances. Clean factory-glazed glass immediately after installing windows.

G. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
   1. Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

      a. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 13 34 19

SECTION 21 05 17 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 6200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 21 05 17

SECTION 21 05 18 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. Split-Casting Brass Type: With chrome-plated finish and with concealed hinge and setscrew.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 21 05 18

SECTION 21 05 53 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material: Multilayer, multicolor, plastic labels for mechanical engraving.
2. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving.

B. Fasteners: Stainless-steel rivets or self-tapping screws.

C. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

E. Pipe-Label Colors:

1. Background Color: Safety Red.
2. Letter Color: White.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Pipe-Label Locations: Locate pipe labels where piping is exposed; mechanical rooms.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes.

END OF SECTION 21 05 53

SECTION 21 1100 - FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes fire-suppression water-service piping and related components inside the building and the following:

1. Pipes, fittings, and specialties.
2. Fire-suppression specialty valves.

B. Related Requirements:

1. Section 21 1119 "Fire-Department Connections" for exposed-, flush-, and yard-type, fire-department connections.
2. Section 21 1200 "Fire-Suppression Standpipes" for fire-suppression standpipes inside the building.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Comply with FM Global's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

C. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Fire-Suppression Water-Service Piping: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions:

1. Notify Construction Manager and Owner no fewer than 3 days in advance of proposed interruption of service.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end or cast iron flanges.

B. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Flanges: ASME B16.1, Class 125, cast iron.

2.2 JOINING MATERIALS

A. Gaskets for Ferrous Piping: ASME B16.21, asbestos free.

2.3 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.4 BACKFLOW PREVENTERS

A. Double-Check, Detector-Assembly Backflow Preventers:

1. Standards: ASSE 1048 and UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 10 psig (70 kPa) maximum, through middle one-third of flow range.
4. Body Material: Cast iron.
5. End Connections: Flanged.
6. Accessories:

a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Comply with NFPA 24 for fire-service-main piping materials and installation.

B. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

C. Comply with requirements in Section 21 1200 "Fire-Suppression Standpipes," and Section 21 1313 "Wet-Pipe Sprinkler Systems," for fire-suppression-water piping inside the building.

D. Comply with requirements in Section 22 1116 "Domestic Water Piping" for potable-water piping inside the building.

E. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 0517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

F. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 21 0517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

3.2 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.

B. Install flanges or flange adaptor on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

C. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.

D. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

E. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.

3.3 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Locking mechanical joints.
2. Set-screw mechanical retainer glands.
3. Bolted flanged joints.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.

3.4 VALVE INSTALLATION

A. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

B. UL-Listed or FM Global-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

C. UL-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.

3.5 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated.

B. Do not install bypass piping around backflow preventers.

C. Backflow Preventers are to be tested twice with documented reports by Contractor – First upon initial installation (Substantial Completion), Second upon approach of 11 Month Walk-Thru/Warranty Expiration. Provide reports to owner upon completion.

3.6 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire-department connection to mains.

B. Install protective pipe bollards at each freestanding fire-department connection. Pipe bollards are specified in Section 05 5000 "Metal Fabrications."

3.7 CONNECTIONS

A. Connect fire-suppression water-service piping to interior fire-suppression piping.

3.8 FIELD QUALITY CONTROL

A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.

END OF SECTION 21 11 00

SECTION 21 11 19 - FIRE-DEPARTMENT CONNECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Comply with local fire authority requirements for Fire Department Connection size, type and location.

1.2 SUMMARY

A. Section Includes:

1. Storz wall-type fire-department connections.
2. Storz yard-type fire-department connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection.

PART 2 - PRODUCTS

2.1 WALL-TYPE FIRE-DEPARTMENT CONNECTION

A. Standard: UL 405 and NFPA 1963.

B. Type: wall mounting.

C. Pressure Rating: 175 psig (1200 kPa) minimum.

D. Body Material: Forged aluminum.

E. Inlets: with threads according to NFPA 1963 and matching local fire-department sizes and threads.

F. Caps: with tether chain.

G. Escutcheon Plate: Ring, cast, wall type.

H. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE or STANDPIPE."

2.2 YARD-TYPE FIRE-DEPARTMENT CONNECTION

A. Standard: UL 405 and NFPA 1963.

B. Type: Exposed, freestanding.

C. Pressure Rating: 175 psig (1200 kPa) minimum.

D. Body Material: Forged aluminum connection.

E. Inlets: with threads according to NFPA 1963 and matching local fire-department sizes and threads.

F. Caps: with tether chain.

G. Escutcheon Plate: Round, cast, floor type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire-department connections.

B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-type fire-department connections.

B. Install yard-type fire-department connections in concrete slab support. Comply with requirements for concrete in Section 03 3000 "Cast-in-Place Concrete."

C. Install protective pipe bollards at each fire-department connection. Comply with requirements for bollards in Section 05 5000 "Metal Fabrications."

D. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION 21 11 19

SECTION 21 1313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND SCOPE

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Light weight and thin wall sprinkler piping is not permitted, see Section 2.2.

C. Provide water supply flow test header with hose valves, per local fire authority.

D. Include enough removable pipe sections to comply with NFPA requirements for future piping internal inspections.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Sprinklers.
4. Alarm devices.
5. Manual control stations.
6. Control panels.
7. Pressure gages.

B. Related Sections:

1. Section 21 1119 "Fire-Department Connections" for exposed-, flush-, and yard-type fire-department connections.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig (1200 kPa) maximum.

1.4 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

B. Deluge Sprinkler System: Open sprinklers are attached to piping connected to water supply through deluge valve. Fire-detection system, in same area as sprinklers, opens valve. Water flows into piping system and discharges from attached sprinklers when valve opens.

1.5 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.

B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Fire-hydrant flow test records shall be obtained by this contractor as the basis for his design. For purposes of bidding flow test data is provided on the drawings.

2. Margin of Safety for Available Water Flow and Pressure: 5 percent, including losses through water-service piping, valves, and backflow preventers.

C. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Minimum Density for Automatic-Sprinkler Piping Design shall be as indicated on the drawings or greater if required by applicable codes.

2. Maximum Protection Area per Sprinkler: Per UL listing.

3. Total Combined Hose-Stream Demand Requirement: According to NFPA 13.

D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content and chemical components.

C. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

D. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. Compressed air piping.
3. HVAC hydronic piping.
4. Items penetrating finished ceiling include the following:

a. Lighting fixtures.

b. Air outlets and inlets.

F. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

G. Fire-hydrant flow test report.

H. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.8 PROJECT CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than 3 days in advance of proposed interruption of sprinkler service.

1.9 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

A. Threaded-End, Schedule 40 Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.

1. Cast-Iron Threaded Flanges: ASME B16.1.
2. Malleable-Iron Threaded Fittings: ASME B16.3.
3. Gray-Iron Threaded Fittings: ASME B16.4.
4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.

B. Grooved-End, Schedule 40 thru 10” NPS and 3/8” thickness 12” NPS and larger steel pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, square-cut- or roll -grooved ends. (Note: This is ANSI defined standard weight steel pipe, lighter wall piping is not permitted.)

1. Grooved-Joint Piping Systems:

a. Available Manufacturers:

1) Anvil Gruvlock
2) Central Sprinkler Corp.
3) Star Pipe Products; Star Fittings Div.
4) Tyco Fire & Building Products LP
5) Victaulic Co. of America.

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick.

1. Class 125, Cast-Iron Flanges Flat-Face Flanges: Full-face gaskets.
2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig (1200 kPa).

B. Ball Valves:

1. Standard: UL 1091 except with ball instead of disc.
2. Valves NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
3. Valves NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductile-iron body with grooved ends.
4. Valves NPS 3 (DN 80): Ductile-iron body with grooved ends.

C. Iron Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig (1200 kPa).
3. Body Material: Cast or ductile iron.
4. Style: Lug or wafer.
5. End Connections: Grooved.

D. Check Valves:

1. Standard: UL 312.
2. Pressure Rating: 125 psig (1200 kPa) minimum.
3. Type: Swing check.
4. Body Material: Cast iron.
5. End Connections: Flanged or grooved.

E. Iron OS&Y Gate Valves:

1. Standard: UL 262.
2. Pressure Rating: 125 psig (1200 kPa) minimum.
3. Body Material: Cast or ductile iron.
4. End Connections: Flanged or grooved.

F. Indicating-Type Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Valves NPS 2 (DN 50) and Smaller:

    a. Valve Type: Ball or butterfly.
    b. Body Material: Bronze.
    c. End Connections: Threaded.

4. Valves NPS 2-1/2 (DN 65) and Larger:

    a. Valve Type: Butterfly.
    b. Body Material: Cast or ductile iron.
    c. End Connections: Flanged, grooved, or wafer.

G. NRS Gate Valves:

1. Standard: UL 262.
2. Pressure Rating: 250 psig (1725 kPa) minimum.
3. Body Material: Cast iron with indicator post flange.
4. Stem: Nonrising.
5. End Connections: Flanged or grooved.

H. Indicator Posts:

1. Standard: UL 789.
2. Type: Horizontal for wall mounting.
3. Body Material: Cast iron with extension rod and locking device.
4. Operation: Wrench for yard mounted and Hand wheel for wall mounted.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig (1200 kPa) minimum.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:

    a. Standard-Pressure Piping Specialty Valves: 175 psig (1200 kPa) minimum.

3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Standard: UL 193.
2. Design: For horizontal or vertical installation.
3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
4. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
5. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Deluge Valves:

1. Standard: UL 260.
2. Design: Hydraulically operated, differential-pressure type.
3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.
4. Wet, Pilot-Line Trim Set: Include gage to read push-rod chamber pressure, globe valve for manual operation of deluge valve, and connection for actuation device.

D. Automatic (Ball Drip) Drain Valves:

1. Standard: UL 1726.
2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4 (DN 20) minimum.
5. End Connections: Threaded.

2.7 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Standard: UL 213.
2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
4. Type: Mechanical-T and -cross fittings.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

C. Branch Line Testers:

1. Standard: UL 199.
2. Pressure Rating: 175 psig (1200 kPa).
3. Body Material: Brass.
4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Standard: UL 1474.
2. Pressure Rating: 250 psig (1725 kPa) minimum.
3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
4. Size: Same as connected piping.

5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

F. Flexible, Sprinkler Hose Fittings:

1. Standard: UL 1474.
2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
3. Pressure Rating: 175 psig (1200 kPa).
4. Size: Same as connected piping, for sprinkler.

2.8 SPRINKLERS

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.

B. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.

C. Open Sprinklers with Heat-Responsive Element Removed: UL 199.

D. Sprinkler Finishes:

1. Chrome plated.
2. Bronze.
3. Painted.

E. Special Coatings:

1. Wax.
2. Lead.
3. Corrosion-resistant paint.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Plastic, white finish, one piece, flat.
2. Sidewall Mounting: Plastic, white finish, one piece, flat.

G. Sprinkler Guards:

1. Standard: UL 199.
2. Type: Wire cage with fastening device for attaching to sprinkler.

2.9 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Standard: UL 753.
2. Type: Mechanically operated, with Pelton wheel.
3. Alarm Gong: Cast aluminum with red-enamel factory finish.
4. Components: Shaft length, bearings, and sleeve to suit wall construction.

C. Electrically Operated Alarm Bell:

1. Standard: UL 464.
2. Type: Vibrating, metal alarm bell.
3. Finish: Red-enamel factory finish, suitable for outdoor use.

D. Water-Flow Indicators:

1. Standard: UL 346.
2. Water-Flow Detector: Electrically supervised.
3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
4. Type: Paddle operated.
5. Design Installation: Horizontal or vertical.

E. Pressure Switches:

1. Standard: UL 346.
2. Type: Electrically supervised water-flow switch with retard feature.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design Operation: Rising pressure signals water flow.

F. Valve Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.

G. Indicator-Post Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled indicator-post valve is in other than fully open position.

2.10 MANUAL CONTROL STATIONS

A. Description: UL listed or FM approved, hydraulic operation, with union, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.11 CONTROL PANELS

A. Description: Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire-alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.

1. Panels: UL listed and FM approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
2. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
3. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.12 PRESSURE GAGES

A. Standard: UL 393.

B. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.

C. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum.

D. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

E. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

2.13 FLOW TEST HEADER AND VALVES

A. Include flow test headers where required by local fire authority.

B. Description: UL 668, brass or bronze, 300-psig (2070-kPa) minimum pressure rating, hose valves for connecting fire hoses. Include angle angle or gate gate pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 2-1/2 (DN 65) as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.

1. Valve Operation: Nonadjustable type.
2. Finish: Rough metal casting.

2.14 FLUSHING CONNECTION

A. Description: Provide hose valves on a header at fire protection water entry location to be utilized for flushing & backflow preventer testing. Coordinate with Fire Department (AHJ) for quantity, type, size and location of valves.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 21 1100 "Facility Fire-Suppression Water-Service Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 21 1100 "Facility Fire-Suppression Water-Service Piping."

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.3 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

N. Pressurize and check preaction sprinkler system piping and air-pressure maintenance devices.

O. Fill sprinkler system piping with water.

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 0517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 21 0517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 21 0518 "Escutcheons for Fire-Suppression Piping."

3.4 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and with NFPA 13 or NFPA 13R for supports.

3.6 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.
3. Deluge Valves: Install in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.7 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.8 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.11 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with [threaded ends; cast-iron threaded fittings; and threaded] [grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved] joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Standard-pressure, wet-pipe sprinkler system, NPS 10 and smaller, shall be the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.12 SPRINKLER SCHEDULE

A. Provide sprinkler types as indicated on the drawings. ONLY USE THE FOLLOWING SPECIFICATIONS IF NOT INDICATED ON THE DRAWINGS.

B. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Wall Mounting: Sidewall sprinklers.
3. Deluge-Sprinkler Systems: open sprinklers.
4. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where required to comply.
5. Where required to maintain fire separation at glass, install pendant vertical sidewall sprinklers for the Water Curtain system per NFPA 13 requirements, below the window frame and near the glass window.

END OF SECTION 21 13 13

SECTION 22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 22 05 13

SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2.4 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide [1-inch (25-mm)] annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 22 0517

SECTION 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

B. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed and exposed-rivet hinge, and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:
   a. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
   b. Bare Piping at Wall Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.

c. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.

2. Escutcheons for Existing Piping:
   a. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
   b. Bare Piping at Wall Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
   c. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 22 05 18

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder-joint connections.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

2.2 GENERAL-DUTY VALVES

A. Valve Sizes: Same as upstream piping unless otherwise indicated.

B. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions.

C. Two-Piece, Bronze Ball Valves with Full Port, and Bronze or Brass Trim:

1. Manufacturers
   a. Conbraco Industries, Inc; Apollo Division
   b. Crane Company; Crane Valve Group; Crane Valves
   c. Crane Company; Crane Valve Group; Jenkins Valves
   d. Crane Company; Crane Valve Group; Stockham Division
   e. DynaQuip Controls
   f. Flow-Tek, Inc
   g. Grinnell Corporation
   h. Hammond Valve
   i. Honeywell Braukmann
   j. Jamesbury, Inc.
   k. Jomar International, LTD.
   l. Kitz Corporation of America.
   m. Legend Valve & Fitting, Inc.
   n. Milwaukee Valve Company.
   o. Nexus Valve Specialties.
   p. Nibco Inc.
   q. R & M Energy Systems (Borger, TX).

r. Red-White Valve Corp.
s. Richards Industries; Marwin Ball Valves.
t. Watts Industries, Inc.; Water Products Div.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig (4140 kPa).
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Bronze or brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

D. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers:
a. Bronze, Swing Check Valves with Nonmetallic Disc:
b. Cincinnati Valve Co.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Div.
f. Grinnell Corporation.
g. Hammond Valve.
h. McWane, Inc.; Kennedy Valve Div.
i. Milwaukee Valve Company.
j. Nibco Inc.
k. Red-White Valve Corp.
l. Walworth Co.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: PTFE.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use ball valves for shutoff duty; globe and ball for throttling duty.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves for each fixture and item of equipment.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in a position to allow full stem movement.

F. Install check valves for proper direction of flow in horizontal position with hinge pin level.

END OF SECTION 22 05 23

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, and system contents.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 HANGERS AND SUPPORTS FOR PLUMBING PIPING EQUPMENT

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Fastener Systems:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

C. Miscellaneous Materials:

1. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
2. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

a. Properties: Nonstaining, noncorrosive, and nongaseous.

b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 GENERAL PIPING INSTALLATIONS

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

3.2 HANGERS AND SUPPORTS

A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.

B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.

C. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches (100 mm) thick.

D. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).

F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

END OF SECTION 22 05 29

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Pipe labels.
   2. Valve tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

   1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.2 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain or beaded chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

C. Pipe Label Color Schedule:

1. Domestic Water Piping

a. Background: Safety green.
b. Letter Colors: White.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. 1-1/2 inches (38 mm), round.

2. Valve-Tag Colors:

a. Cold Water: Natural.
b. Hot Water: Natural
c. Low-Pressure Compressed Air: Natural
d. High-Pressure Compressed Air: Natural

END OF SECTION 22 05 53

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product.
2. For adhesives and sealants, documentation including printed statement of VOC content and chemical components.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less according to ASTM E 84.

B. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less according to ASTM E 84.

2.2 INSULATION MATERIALS

A. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

B. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

C. Mineral-Fiber, Preformed Pipe Insulation:

2.3 ADHESIVES

A. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less.

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less.

2.4 MASTICS

A. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

B. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.5 SEALANTS

A. Joint Sealants for Cellular-Glass Products:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches (75 mm).
2. Thickness: 11.5 mils (0.29 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

PART 3 - EXECUTION

3.1 PIPE INSULATION INSTALLATION

A. Comply with requirements of the Midwest Insulation Contractors Association's "National Commercial & Industrial Insulation Standards" for insulation installation on pipes and equipment.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall, Partition, and Floor Penetrations: Install insulation continuously through penetrations. Seal penetrations. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

D. Flexible Elastomeric Insulation Installation:

1. Seal longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

E. Mineral-Fiber Insulation Installation:

1. Insulation Installation on Straight Pipes and Tubes: Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
3. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

F. Interior Piping System Applications: Insulate the following piping systems:

1. Domestic hot water.
2. Recirculated domestic hot water.
3. Exposed water supplies and sanitary drains of fixtures for people with disabilities.

G. Do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Sanitary drainage and vent piping.
3. Drainage piping located in crawlspaces unless otherwise indicated.
4. Chrome-plated pipes and fittings, except for plumbing fixtures for people with disabilities.
5. Piping specialties, including air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.2 INDOOR PIPING INSULATION SCHEDULE

A. Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawlspaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

B. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

C. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32)> and Smaller: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.

END OF SECTION 22 07 00

SECTION 22 11 13 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Summary: This Section includes water-distribution piping outside the building for combined water service and fire-service mains.

B. Submittals:

1. Product Data: For each type of product.

1.2 FIELD CONDITIONS

A. Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of service, and do not proceed without written permission.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

B. Comply with NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances," for materials.

C. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.

D. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

2.2 PIPE AND FITTINGS

A. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) or ASTM B 88, Type L (ASTM B 88M, Type B) water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

2.3 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8, BCuP Series.

B. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.4 SLEEVES AND SLEEVE SEALS

A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

B. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

C. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

D. Sleeve-Seal Systems:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

a. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
b. Pressure Plates: Stainless steel.
c. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Comply with NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances," for installations, tests, and flushing.

B. Water-Main Connection: Arrange with utility company for tap of size and in location indicated Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Comply with NFPA 24 for fire-service-main piping materials and installation.

1. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

D. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

E. Bury piping with depth of cover over top at least 30 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration.

F. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

G. Sleeves:

1. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
2. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

a. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

3. Install sleeves for pipes passing through interior partitions.
4. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

H. Sleeve-Seal-System Installation:

1. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
2. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

I. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

J. Anchorage, General: Install water-distribution piping with restrained joints. As required by authorities having jurisdiction.

3.2 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

B. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water-distribution piping to interior domestic water and fire-suppression piping.

3.4 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

1. Prepare reports of testing activities.

3.5 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

B. Prepare reports of purging and disinfecting activities.

3.6 PIPING APPLICATION SCHEDULE

A. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

B. Do not use flanges or unions for underground piping.

C. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

D. Aboveground water-service piping shall be the following:

1. Hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) or ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved

E. Aboveground combined water service and fire-service-main piping shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

3.7 VALVE APPLICATION SCHEDULE

A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Use the following for valves in vaults and aboveground:

      a. Gate Valves, NPS 2 (DN 50) and Smaller: Bronze, rising stem.
      b. Gate Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, OS&Y rising stem, resilient seated

END OF SECTION 22 11 13

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data:

a. For transition fittings and dielectric fittings.
b. For solvent cements and adhesive primers, documentation including printed statement of VOC content.

1.2 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. System purging and disinfecting activities report.

C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PREFORMANCE REQUIREMENTS

A. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 PIPE AND FITTINGS

A. Hard Copper Tubing: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper with wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

1. Copper Unions: Cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
2. Joining Materials: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder.

B. Soft Copper Tubing: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), water tube, annealed temper with copper pressure fittings, cast-copper-alloy or wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

1. Joining Materials: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder.

C. Special-Duty Valves:

1. Comply with requirements in Section 22 05 23 "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
2. Comply with requirements in Section 22 11 19 "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

D. Flexible Connectors: Stainless-steel, corrugated-metal tubing with wire-braid covering. Working-pressure rating a minimum of 200 psig (1380 kPa).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

C. Install unions at final connection to each piece of equipment.

D. Install dielectric unions and flanges to connect piping materials of dissimilar metals in gas piping.

E. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water piping.

F. Soldered Joints: Comply with procedures in ASTM B 828 unless otherwise indicated.

G. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Section 22 11 19 "Domestic Water Piping Specialties" for drain valves and strainers.

H. Install domestic water piping without pitch for horizontal piping and plumb for vertical piping.

I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

J. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

1. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

a. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
b. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
c. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
d. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
e. Support vertical piping at each floor.
f. Install hangers for vertical PEX piping every 48 inches (1200 mm).

3.2 INSPECTING AND CLEANING

A. Inspect and test piping systems as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

B. Clean and disinfect potable and non-potable domestic water piping by filling system with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

3.3 PIPING SCHEDULE

A. Underground, Service Entrance Piping: Soft copper tubing

B. Aboveground Distribution Piping: Type L (Type B), hard copper tubing

3.4 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball valves for piping NPS 2 (DN 50) and smaller.
2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 (DN 50) and smaller.
3. Hot-Water-Piping, Balancing Duty: Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Install gate valves close to main on each branch and riser serving two or more plumbing fixtures or equipment connections and where indicated.

C. Install ball valves on inlet to each plumbing equipment item, on each supply to each plumbing fixture not having stops on supplies, and elsewhere as indicated.

D. Install drain valve at base of each riser, at low points of horizontal runs, and where required to drain water distribution piping system.

E. Install ball valves in each hot-water circulating loop and discharge side of each pump.

END OF SECTION 22 11 16

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product.
2. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 and NSF 14. Mark "NSF-pw" on plastic piping components.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa) unless otherwise indicated.

2.3 MANUFACTURED UNITS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:
1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded, complying with ASME B1.20.7.
4. Finish: Rough bronze.

C. Reduced-Pressure-Principle Backflow Preventers:

2.4 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers :
1. Manufacturers:
a. Ames Co., Inc.
b. Cla-Val Co.
c. CMB Industries, Inc.; Febco Backflow Preventers.
d. Conbraco Industries, Inc.

e. IMI Cash Valve.
f. Mueller Co.; Hersey Meters Div.
g. Watts Industries, Inc.; Water Products Div.
h. Zurn Industries, Inc.; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. See schedule on drawings.

B. Double-Check, Backflow-Prevention Assemblies:
1. Manufacturers:
a. Ames Co., Inc.
b. Cla-Val Co.
c. CMB Industries, Inc.; Febco Backflow Preventers.
d. Conbraco Industries, Inc.
e. IMI Cash Valve.
f. Mueller Co.; Hersey Meters Div.
g. Watts Industries, Inc.; Water Products Div.
h. Zurn Industries, Inc.; Wilkins Div.

2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications unless otherwise indicated.
4. See schedule on drawings.

C. Memory-Stop Balancing Valves:

1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 2 (DN 50) or smaller.
4. Body: Copper alloy.
5. Port: Standard or full port.
6. Ball: Chrome-plated brass.
7. Seats and Seals: Replaceable.
8. End Connections: Solder joint or threaded.
9. Handle: Vinyl-covered steel with memory-setting device.
10. Use for domestic hot water recirculation.

D. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Cash Acme.
b. Conbraco Industries, Inc.
c. Powers; a Watts Industries Co.
d. Watts Industries, Inc.; Water Products Div.
e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1070, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 110 deg F.
9.].

E. Y-Pattern Strainers:

1. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Drain: Pipe plug.

F. Water-Hammer Arresters:
1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Metal bellows.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

G. Supply-Type, Trap-Seal Primer Device:
1. Standard: ASSE 1018.
2. Pressure Rating: 125 psig (860 kPa) minimum.
3. Body: Bronze.
4. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
5. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

B. Install balancing valves in locations where they can easily be adjusted.

C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

D. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.

E. Install water-hammer arresters in water piping according to PDI-WH 201.

F. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each double-check, backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.

2. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
3. Prepare test and inspection reports.

END OF SECTION 22 11 19

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product.
2. For solvent cements and adhesive primers, documentation including printed statement of VOC content.
3. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1.2 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and elevations, or Building Information Model (BIM) drawn to scale, showing items described in this Section and coordinated with all building trades.

B. Field quality-control reports.

1.3 FIELD CONDITIONS

A. Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service and do not proceed without written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components.

2.2 PIPES AND FITTINGS

A. Hubless Cast-Iron Soil Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Cast-Iron, Hubless-Piping Couplings:

1. Standard: ASTM C 1277.
2. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. PVC Plastic, DWV Pipe and Fittings: ASTM D 2665, Schedule 40, plain ends with PVC socket-type, DWV pipe fittings.

1. Adhesive Primer: ASTM F 656.

a. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Solvent Cement: ASTM D 2564.

a. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Comply with requirements in Section 22 1113 "Facility Water Distribution Piping" for basic piping installation requirements.

B. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

C. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Section 22 1113 "Facility Water Distribution Piping" for wall penetration systems.

1. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

D. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

E. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

F. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

G. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

H. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

J. Comply with requirements in Section 22 1113 "Facility Water Distribution Piping" for basic piping joint construction.

K. Comply with requirements in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

3.2 PIPE SCHEDULE

A. Aboveground Applications: Hubless, cast-iron soil pipe and fittings or [PVC plastic, DWV pipe and fittings with solvent-cemented joints.

B. Belowground Applications: PVC plastic, DWV pipe and drainage-pattern fittings with cemented joints.

END OF SECTION 22 13 16

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product.

a. Include rated capacities, operating characteristics, and accessories for grease interceptors.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

2.2 CLEANOUTS

A. Metal Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:
   a. Application: Floor cleanout.
   b. Body or Ferrule Material: Cast iron
   c. Body or Ferrule Material: Cast iron.
   d. Outlet Connection: Threaded.
   e. Closure: Plastic plug.
   f. Top Loading Classification: Medium Duty

B. Cast-Iron Wall Cleanouts :

1. Standard: ASME A112.36.2M. Include wall access.

2. Body or Ferrule Material: Cast iron.
3. Clamping Device: Not required.
4. Outlet Connection: Inside calk.
5. Closure: Cadmium.
6. Frame and Cover Material and Finish: Stainless steel .
7. Frame and Cover Shape: Round w/vandal-proof screw.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Standard: ASME A112.6.3.
2. Pattern: Floor drain.

3. Body Material: Gray iron.
4. Seepage Flange: Required.
5. Clamping Device: Required.
6. Outlet: Bottom.
7. Backwater Valve: Not required.
8. Coating on Interior and Exposed Exterior Surfaces: Not required.
9. Sediment Bucket: [Not required] <Insert description>.
10. Top or Strainer Material: Nickel bronze.
11. Top of Body and Strainer Finish: Nickel bronze.
12. Top Shape: Round.
13. Dimensions of Top or Strainer: Round, 6” diameter.
14. Top Loading Classification: Medium Duty.
15. Funnel: Not required.
16. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
17. Trap Pattern: Deep-seal P-trap.
18. Trap Features: Trap-seal primer valve drain connection

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

B. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor unless otherwise indicated.

1. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
2. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

END OF SECTION 22 13 19

SECTION 22 13 19.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Trench drains.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene styrene.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene.

D. PE: Polyethylene.

E. PP: Polypropylene.

F. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 TRENCH DRAINS

A. Trench Drains:
   1. Manufacturers:
      a. Josam Co., Blucher-Josam Div.

b. Smith, Jay R. Mfg. Co.
c. Tyler Pipe, Wade Div.
d. Watts Industries, Inc., Drainage Products Div.
e. Zurn Industries, Inc., Jonespec Div.

2. Standard: ASME A112.6.3 for trench drains.
3. Material: Ductile or gray iron.
4. Flange: Seepage.
5. Clamping Device: Required.
6. Outlet: Bottom.
7. Grate Material: Ductile iron or gray iron.
8. Grate Finish: Not required.
9. Dimensions of Frame and Grate: See Drawings
10. Top Loading Classification: Extra Heavy Duty.
11. Trap Material: Cast iron.
12. Trap Pattern: Standard P-trap.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install trench drains at low points of surface areas to be drained.

1. Set grates of drains flush with finished surface, unless otherwise indicated.

B. Comply with ASME A112.3.1 for installation of stainless-steel channel drainage systems.

1. Install on support devices, so that top will be flush with adjacent surface.

3.2 CONNECTIONS

A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19.13

SECTION 22 15 13 - GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes piping and related specialties for general-service compressed-air systems, as follows:

1. Pipes, tubes, and fittings.
2. Joining materials.
3. Dielectric fittings.
4. Flexible pipe connectors.
5. Specialties.

B. Related Requirements:

1. Section 22 15 19 "General-Service Packaged Air Compressors and Receivers" for general-service air compressors and accessories.

1.2 ACTION SUBMITTALS

A. Product Data:
1. Flexible pipe connectors.
2. Safety valves.
3. Pressure regulators. Include rated capacities and operating characteristics.
4. Automatic drain valves.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Brazing certificates.

B. Field Quality-Control Submittals:

1. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Brazing: Qualify processes and operators in accordance with ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or with AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

1. >.

B. ASME Compliance:

1. Comply with ASME B31.3, "Process Piping," for low-pressure, compressed-air piping.
2. Comply with ASME B31.9, "Building Services Piping," for low-pressure, compressed-air piping.

2.2 PIPES, TUBES, AND FITTINGS

A. Schedule 40, Steel Pipe: ASTM A53/A53M, Type E or S, Grade B, black or hot-dip zinc coated with ends threaded in accordance with ASME B1.20.1.

1. Steel Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
5. Wrought-Steel, Butt-Welding Fittings: ASME B16.9, Schedule 40.
6. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel.

B. Copper Tube: ASTM B88, Type K or L (ASTM B88M, Type A or B) seamless, drawn-temper, water tube.

1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
3. Copper Unions: ASME B16.22 or MSS SP-123.

C. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux in accordance with ASTM B813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
1. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C)]
c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.5 FLEXIBLE PIPE CONNECTORS

A. Stainless Steel-Hose Flexible Pipe Connectors: Corrugated, stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: 200 psig (1380 kPa) minimum.
2. End Connections, NPS 2 (DN 50) and Smaller: Threaded steel pipe nipple.

2.6 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.

1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for [250 psig (1725 kPa)] <Insert pressure> inlet pressure, unless otherwise indicated.

1. Type: Pilot operated.

C. Air-Line Pressure Regulators, Bronze Body: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200 psig (1380 kPa) minimum inlet pressure, unless otherwise indicated.

D. Automatic Drain Valves: Stainless steel body and internal parts, rated for 200 psig (1380) kPaminimum working pressure, capable of automatic discharge of collected condensate.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Compressed-Air Piping between Air Compressors and Receivers: Use one of the following piping materials for each size range:

1. NPS 2 (DN 50) and Smaller: Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.

2. NPS 2 (DN 50) and Smaller: Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed joints.

B. Low-Pressure Compressed-Air Distribution Piping: Use one of the following piping materials for each size range:

1. NPS 2 (DN 50) and Smaller: Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.
2. NPS 2 (DN 50) and Smaller: Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed joints.

3.2 VALVE APPLICATIONS

A. Metal General-Duty Valves: Comply with requirements and use valve types specified according to the following:

1. Low-Pressure Compressed Air: Valve types specified for low-pressure compressed air.
2. Equipment Isolation NPS 2 (DN 50) and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

B. General-Duty Valves for Aluminum Piping System: Provide valves, made by piping system manufacturer, that are compatible with piping.

1. Ball Valves, NPS 2 (DN 50) and Smaller: NPT ends, or push-connect bite ring ends.

3.3 INSTALLATION OF PIPING, GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless otherwise indicated.

D. Where installing piping adjacent to equipment and machines, allow space for service and maintenance.

E. Install air and drain piping with 1 percent slope downward in direction of flow.

F. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating unless otherwise indicated.

G. Equipment and Specialty Flanged Connections:

1. Use steel companion flange with gasket for connection to steel pipe.
2. Use cast-copper-alloy companion flange with gasket and brazed or soldered joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.

H. Extended-tee outlets with brazed branch connection may be used for copper tubing, within extruded-tee connection diameter to run tube diameter ratio for tube type, in accordance with Extruded Tee Connections Sizes and Wall Thickness for Copper Tube (Inches) Table in ASTM F2014.

I. Install concentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

J. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

K. Install piping to permit valve servicing.

L. Install piping free of sags and bends.

M. Install fittings for changes in direction and branch connections.

N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.4 INSTALLATION OF ALUMINUM PIPING SYSTEMS

A. Install aluminum piping systems in accordance with manufacturer's written instructions, using manufacturer's recommended tools, accessories, and methods.

B. Install branch connections NPS 2 (DN 50) and smaller, to compressed-air mains using aluminum piping system reducing outlet tee with water trapping capabilities. Provide drain leg and drain trap at end of each main and branch and at low points.

3.5 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Brazed Joints for Copper Tubing: Join in accordance with AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

E. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Join in accordance with ASTM B828 or CDA's "Copper Tube Handbook."

F. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts in accordance with ASME B31.9 for bolting procedure.

G. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.6 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. NPS 2 (DN 50) and Smaller: Use dielectric unions.

3.7 INSTALLATION OF FLEXIBLE PIPE CONNECTORS

A. Install flexible pipe connectors in discharge piping of each air compressor.

B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.

C. Install stainless steel-hose flexible pipe connectors in steel compressed-air piping.

3.8 INSTALLATION OF SPECIALTIES

A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.

B. Install air-main pressure regulators in compressed-air piping at or near air compressors.

C. Install air-line pressure regulators in branch piping to equipment.

D. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.

3.9 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for hangers, supports, and anchor devices.

B. Install hangers for copper tubing and steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Support horizontal piping within 12 inches (300 mm) of each fitting and coupling.

D. Support vertical runs of copper tubing and steel piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Individual, Straight, Horizontal Piping Runs:

1. 100 Ft. (30 m) or Less: MSS Type 1, adjustable, steel clevis hangers.
2. Longer Than 100 Ft. (30 m): MSS Type 43, adjustable roller hangers.

F. Multiple, Straight, Horizontal Piping Runs 100 Ft. (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

G. Base of Vertical Piping: MSS Type 52, spring hangers.

3.10 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.11 FIELD QUALITY CONTROL

A. Perform field tests and inspections.

B. Tests and Inspections:

1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
2. Repair leaks and retest until no leaks exist.
3. Inspect filters and pressure regulators for proper operation.

C. Prepare test and inspection reports.

END OF SECTION 22 15 13

SECTION 22 15 19 - GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS

1.1 SUMMARY

A. Section Includes:

1. Lubricated, reciprocating air compressors.

1.2 DEFINITIONS

A. Actual Air: Air delivered from air compressors. Flow rate is delivered compressed air measured in acfm (actual L/s).

B. Standard Air: Free air at 68 deg F (20 deg C) and 1 atmosphere (29.92 in. Hg) before compression or expansion and measured in scfm (standard L/s).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.

2.2 GENERAL REQUIREMENTS FOR PACKAGED AIR COMPRESSORS AND RECEIVERS

A. General Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air.

B. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1. Pressure Rating: At least as high as highest discharge pressure of connected compressors, and bearing appropriate code symbols.

2. Interior Finish: Corrosion-resistant coating.
3. Accessories: Include safety valve, pressure gage, drain, and pressure-reducing valve.

2.3 LUBRICATED, RECIPROCATING AIR COMPRESSORS

A. Manufacturer's
   1. Ingersoll Rand
   2. Atlas Copco

B. Compressor(s): Lubricated, reciprocating-piston type with lubricated compression chamber and crankcase.

   1. Submerged gear-type oil pump.
   2. Oil filter.
   3. Combined high discharge-air temperature and low lubrication-oil pressure switch.
   4. Belt guard totally enclosing pulleys and belts.

C. Capacities and Characteristics: See drawings.

2.4 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 22 05 13 "Common Motor Requirements for Plumbing Equipment."

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Equipment Mounting:

   1. Install air compressors and air dryers on cast-in-place concrete equipment base(s).
   2. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."

B. Install compressed-air equipment anchored to substrate.

C. Arrange equipment so controls and devices are accessible for servicing.

D. Maintain manufacturer's recommended clearances for service and maintenance.

E. Install the following devices on compressed-air equipment:

   1. Thermometer, Pressure Gage, and Safety Valve: Install on each compressed-air receiver.
   2. Pressure Regulators: Install downstream from air compressors and dryers.
   3. Automatic Drain Valves: Install on aftercoolers, receivers, and dryers. Discharge condensate over nearest floor drain.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 22 15 13 "General-Service Compressed-Air Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to machine, allow space for service and maintenance.

3.3 IDENTIFICATION

A. Identify general-service air compressors and components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air compressors and air dryers.

END OF SECTION 22 15 19

SECTION 22 34 00 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type and size of domestic-water heater.
2. Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1, Section 7, "Service Water Heating."
3. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.
4. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
5. Operation and maintenance data.

B. Warranties: Submit a written warranty executed by manufacturer agreeing to repair or replace water heaters that fail in materials or workmanship within five years from date of Substantial Completion. Failures include, but are not limited to, tanks and elements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

D. Gas-Fired Water Heaters: Bear AGA certification label.

E. Comply with requirements of applicable NSF, AWWA, or FDA and EPA regulatory standards for tasteless and odorless, potable-water-tank linings.

F. Comply with performance efficiencies prescribed in ASHRAE 90.2, "Energy Efficient Design of New Low-Rise Residential Buildings."

2.2 WATER HEATERS, GENERAL

A. Insulation: Suitable for operating temperature and required insulating value. ASHRAE/IESNA 90.1. Surround entire tank except connections and controls.

B. Anode Rods: Factory installed, replaceable magnesium.

C. Combination Temperature and Pressure Relief Valve: ANSI Z21.22/CSA 4.4-M or ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

D. Drain Valve: ASSE 1005. Factory or field installed.

2.3 GAS-FIRED WATER HEATERS

A. Residential, Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:

1. Manufacturer:
   a. A.O. Smith
   b. American Water Heater
   c. Bradford White Corporation
   d. Rheem Manufacturing Company
   e. State Industries

2. Standard ANSI Z21.10.1/CSA 4.1., 75-gal. capacity and 100 kBtu/h input burner; steel with 150-psig (1035-kPa) working-pressure rating; with adjustable thermostat; automatic gas-ignition system, draft hood; and power-vent system interlocked with burner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install heaters on floor

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.

B. Install temperature and pressure relief valves and extend to closest floor drain.

C. Install vacuum relief valves in cold-water-inlet piping.

D. Install shutoff valves and unions at hot- and cold-water piping connections.

E. Make piping connections with dielectric fittings where dissimilar piping materials are joined.

F. Connect gas water heaters according to NFPA 54. Connect gas vent and draft hoods and diverters where required. Extend to outside and terminate in vent cap.

END OF SECTION 22 34 00

SECTION 22 42 13.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor-mounted water closets
2. Flushometer valves.
3. Toilet seats.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Comply with ASME A112.19.2/CSA B45.1 for water closets.
2. Comply with ASME A112.19.5/CSA B45.15 for flush valves and spuds for water closets and tanks.
3. Comply with ASSE 1037/ASME A112.1037/CSA B125.37 for flush valves.
4. Comply with IAMPO/ANSI Z124.5 for water-closet (toilet) seats.
5. Comply with ASME A112.6.1M for water-closet supports.
6. Comply with ICC A117.1 for ADA-compliant water closets.
7. Comply with ASTM A1045 for flexible PVC gaskets used in connection of vitreous china water closets to sanitary drainage systems.
8. Comply with ASME A112.4.3 for plastic fittings used in connection of vitreous china water closets to sanitary drainage systems.

2.2 WALL-MOUNTED WATER CLOSETS

1. Water Closets, Floor Mounted - Bottom Outlet, Juvenile <Insert drawing designation>:

a. Manufacturers:
1) American Standard
2) Kohler

3) Toto

b. Source Limitations: Obtain water closets from single source from single manufacturer.

c. Standard: ASME A112.19.2/CSA B45.1.

d. Bowl:

1) Material: Vitreous china.
2) Type: Siphon jet.
3) Style: Flushometer valve.
4) Height: 15 inches
5) Rim Contour: Elongated.
6) Water Consumption: 1.28 gal. per flush.
7) Spud Size and Location: NPS 1-1/2 ; top.
8) Color: White.

2.3 FLUSHOMETER VALVES

A. Flushometer Valves - Diaphragm, Lever Handle: <Insert designation>.
1. Manufacturers:
a. Zurn
b. American Standard
c. Sloan
2. Minimum Pressure Rating: 125 psig (860 kPa).
3. Features: Include integral check stop and backflow-prevention device.
4. Material: Brass body with corrosion-resistant components.
5. Style: Exposed.
6. Flushometer-Valve Finish: Chrome-plated.
7. Handle Finish: Chrome-plated.
8. Consumption: 1.28 gal. per flush.
9. Minimum Inlet: NPS 1 (DN 25).
10. Minimum Outlet: NPS 1-1/4 (DN 32).

2.4 TOILET SEATS

A. Toilet Seats:
1. Material: Plastic.
2. Type: Commercial (Heavy duty).
3. Shape: Elongated rim, open front
4. Hinge: Self-sustaining, check
5. Hinge Material: Noncorroding metal.
6. Seat Cover: Not required.
7. Color: White
8. Surface Treatment: Not required

2.5 SUPPORTS

A. Water-Closet Carrier:
1. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.

2.6 TOILET SEATS

A. Toilet Seats:
   1. Material: Plastic.
   2. Type: Commercial (Heavy duty).
   3. Shape: Elongated rim, open front
   4. Hinge: Self-sustaining, check
   5. Hinge Material: Noncorroding metal.
   6. Seat Cover: Not required.
   7. Color: White
   8. Surface Treatment: Not required

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Water-Closet Installation:

   1. Install water closets level and plumb in accordance with roughing-in drawings.
   2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
   3. Install floor-mounted, back-outlet water closets, attached to building floor substrate, onto waste-fitting seals; and attach to support.
   4. Measure support height installation from finished floor, not structural floor.
   5. Install flushometer-valve, water-supply fitting on each supply to each water closet.
   6. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
   7. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
   8. Install actuators in locations easily reachable for people with disabilities.
   9. Install toilet seats on water closets.
   10. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Install deep-pattern escutcheons if required to conceal protruding fittings.
   11. Seal joints between water closets, walls, and floors using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to water-closet color.

B. Flushometer-Valve Installation:

   1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
   2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
   3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
   4. Install actuators in locations easily reachable for people with disabilities.

C. Install toilet seats on water closets.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.

3.3 PIPING CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 13.13

SECTION 22 42 16.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vitreous-china, counter-mounted lavatories.
   2. Supply fittings.
   3. Waste fittings.
   4. Lavatory supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

A. Lavatory - Self-Rimming, Oval or Round, Vitreous China, Counter Mounted
   1. Fixture:

      a. Standard: ASME A112.19.2/CSA B45.1.
      b. Type: For wall hanging.
      c. Nominal Size: Oval, 20 by 18 inches (508 by 457 mm)
      d. Faucet-Hole Punching: One hole
      e. Faucet-Hole Location: Top.
      f. Color: White
      g. Mounting Material: Sealant.
   2. Lavatory Mounting Height: Per Drawings

2.2 MANUALLY OPERATED LAVATORY FAUCETS

A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Lavatory Faucets - Manual Type: Single-control mixing, commercial,

1. Standard: ASME A112.18.1/CSA B125.1.
2. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
3. Body Type: Single hole
4. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
5. Finish: Polished chrome plate
6. Maximum Flow Rate: 0.5 gpm (1.5 L/min.)
7. Mounting Type: Deck, concealed
8. Spout: Rigid type.
9. Spout Outlet: Aerator
10. Drain: Not part of faucet

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key or Wheel handle.

F. Risers:

1. NPS 1/2 (DN 15).
2. ASME A112.18.6/CSA B125.6, braided- or corrugated-stainless steel, flexible hose riser.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 (DN 32) offset and straight tailpiece.

C. Trap:

1. Size:[NPS 1-1/2 by NPS 1-1/4 (DN 40 by DN 32)
2. Material:

a. Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall and chrome-plated, brass or steel wall flange.
b. Stainless steel, two-piece trap and swivel elbow with 0.012-inch- (0.30-mm-) thick stainless steel tube to wall; and stainless steel wall flange.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lavatories level and plumb in accordance with roughing-in drawings.

B. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

C. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

3.2 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 1 116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.3 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

3.4 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 16.13

SECTION 22 42 16.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Kitchen/Utility Sinks
2. Service Sinks
3. Manually operated sink faucets.
4. Automatically operated sink faucets.
5. Supply fittings.
6. Waste fittings.
7. Sink supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 KITCHEN/UTILITY SINKS

A. Kitchen/Utility Sinks - Stainless Steel, Counter Mounted:
1. Manufacturer:
a. Elkay
2. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Type: Stainless steel, self-rimming, sound-deadened unit less ledge back
c. Number of Compartments: One
d. Material: 18 gauge, Type 304 stainless steel.
e. Compartment:
1) Drain: Grid with NPS 2 (DN 50) tailpiece and twist drain
2) Drain Location: Centered in compartment
3) Depth: Wheelchair accessible.

f. Each Compartment:

3. Faucet(s):

a. Number Required: One
b. Mounting: On ledge.

4. Supply Fittings:

    a. Standard: ASME A112.18.1/CSA B125.1.
    b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

        1) Operation: Loose key or Wheel handle
        2) Risers: NPS 1/2 (DN 15), ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose

5. Waste Fittings:

    a. Standard: ASME A112.18.2/CSA B125.2.
    b. Trap(s):

        1) Size: NPS 2 (DN 50).
        2) Material:

            a) Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall and chrome-plated brass or steel wall flange.

    c. Continuous Waste:

        1) Size: NPS 2 (DN 50).
        2) Material: Chrome-plated, 17-gauge brass tube.

6. Mounting: On counter with sealant.

2.2 SERVICE SINKS

A. Service Sinks - Molded Stone, Floor Mounted.
    1. Manufacturers:
        a. Fiat
        b. Crane Plumbing, Inc
        c. Swan Corporation
        d. EL Mustee & Sons
    2. Fixture:

        a. Standard: ASME A112.18.2/CSA B125.2.
        b. Shape: Square
        c. Nominal Size: 24 by 24 inches (610 by 610 mm)
        d. Height: 10 inches (255 mm)
        e. Rim Guard: Manufacturer’s standard
        f. Color: Manufacturer’s standard
        g. Drain: Grid with NPS 3 (DN 80) outlet.

    3. Mounting: On floor and flush to wall.
    4. Faucet: See “Commercial Service Sink Faucets - Manual Type”

2.3 MANUALLY OPERATED SINK FAUCETS

A. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Commercial Sink Faucets - Manual Type: Two-handle mixing

1. Manufacturers
   a. Moen
   b. Kohler
   c. American Standard
2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. Body Type: Centerset
5. Body Material: Commercial, solid brass, or die-cast housing with brazed copper and brass waterway.
6. Finish: Chrome plated
7. Maximum Flow Rate: 1.5 gpm (5.7 L/min)
8. Mounting Type: Deck, exposed]
9. Valve Handle(s): Lever
10. Spout Type: Swing
11. Vacuum Breaker: Not required for hose outlet.
12. Spout Outlet: Aerator

C. Commercial Service Sink Faucets - Manual Type:
1. Manufacturers:
   a. Fiat
   b. Crane Plumbing, Inc
   c. Swan Corporation
   d. EL Mustee & Sons
2. Description: Wall/back mounted, brass body, with integral service stops, checks, spout with bucket/pail hook, 3/4-inch (20-mm) hose thread end, integral vacuum breaker, inlets 8 inches (200 mm) o.c., and two-handle mixing.
3. Faucet:

   a. Standards:

      1) ASME A112.18.1/CSA B125.1.
      2) NSF 61 and NSF 372.
      3) ICC A117.1.
      4) ASSE 1001 (VB).

   b. Finish: Rough chrome plated.
   c. Handles: 6-inch (152-mm) wrist blade
   d. Brace: Adjustable top brace

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key or Wheel handle.

F. Risers:

1. NPS 1/2 (DN 15).
2. ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose

2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 (DN 40) offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 (DN 40).
2. Material:

a. Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall and chrome-plated brass or steel wall flange.

2.6 GROUT

A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install sinks level and plumb in accordance with rough-in drawings.

B. Set floor-mounted sinks in leveling bed of cement grout.

C. Install supports, affixed to building substrate, for wall-hung sinks.

D. Install wall-mounted sinks at accessible mounting height in accordance with ICC A117.1.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping"
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

3.2 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.3 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.4 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 16.16

SECTION 22 47 16 - PRESSURE WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pressure water coolers.
2. Supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler and bottle filling station.

B. Shop Drawings:

1. Include diagrams for power wiring.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Pressure water coolers and bottle filling stations intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 or NSF 372, or be certified in compliance with NSF 61 or NSF 372 by an ANSI-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
2. Comply with ASHRAE 34 for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.
3. Comply with UL 399.
4. Comply with ASME A112.19.3/CSA B45.4.
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Comply with NSF 42 and NSF 53 for water filters for water coolers and bottle filling stations.
7. Comply with ICC A117.1 for accessible water coolers and bottle filling stations.

2.2 PRESSURE WATER COOLERS

A. Pressure Water Coolers - Surface Wall-Mounted High/Low
   1. Manufactures:
      a. Elkay
      b. Halsey Taylor
      c. Oasis
   2. Bubbler: two, with adjustable stream regulator, located on each cabinet deck.
   3. Control: Push bar
   4. Bottle Filler: Sensoractivation
   5. Fill rate 0.5 to 1.5 gpm (0.03155 to 0.09464 L/s).
   6. Drain: Grid with NPS 1-1/4 (DN 32) tailpiece.
   7. Supply: NPS 3/8 (DN 10) with shutoff valve.
   8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 (DN 32) brass P-trap.
   9. Filter: One or more water filters with capacity sized for unit peak flow rate.
   10. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
   11. Support: Water-cooler carrier.
   12. Water-Cooler Mounting Height: High/low - standard/accessible in accordance with ICC A117.1.
   13. Capacities and Characteristics: See Drawings

B. Pressure Water Coolers - Surface Wall-Mounted
   1. Manufactures:
      a. Elkay
      b. Halsey Taylor
      c. Oasis
   2. Bubbler: two, with adjustable stream regulator, located on each cabinet deck.
   3. Control: Push bar
   4. Bottle Filler: Sensoractivation
   5. Fill rate 0.5 to 1.5 gpm (0.03155 to 0.09464 L/s).
   6. Drain: Grid with NPS 1-1/4 (DN 32) tailpiece.
   7. Supply: NPS 3/8 (DN 10) with shutoff valve.
   8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 (DN 32) brass P-trap.
   9. Filter: One or more water filters with capacity sized for unit peak flow rate.
   10. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
   11. Support: Water-cooler carrier.
   12. Capacities and Characteristics: See Drawings

2.3 SUPPORTS

A. Water-Cooler Carrier:
   1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

C. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers, and bottle filling stations to mounting frames.

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping"

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.2 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Install ball shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping"

D. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.3 ELECTRICAL CONNECTIONS

A. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 47 16

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: **Class F**.

J. Code Letter Designation:

1. Motors **15** HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than **15** HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes **324T** and larger; rolled steel for motor frame sizes smaller than **324T**.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13

SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.
6. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

C. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts and nuts for flashing membrane.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20-psig (137-kPa) minimum).
3. Sealing Elements: EPDM-rubber or Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.

2.4 SLEEVE-SEAL FITTINGS

A. Description:

1. Manufactured plastic, sleeve-type, waterstop assembly, made for imbedding in concrete slab or wall.
2. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Description: Nonshrink, recommended for interior and exterior sealing openings in nonfire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke-Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 3 inches (76 mm) above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using waterproof silicone sealant, seal space between top hub of stack-sleeve fitting and pipe.

B. Fire-Resistance-Rated, Horizontal Assembly, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal-system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal space around outside of sleeve-seal fittings.

END OF SECTION 23 05 17

SECTION 23 0523.12 - BALL VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Bronze ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and weld ends.
   3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.18 for solder-joint connections.
4. ASME B31.9 for building services piping valves.

C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. Refer to HVAC valve schedule articles for applications of valves.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:
1. Handlever: For quarter-turn valves smaller than NPS 4 (DN 100).

H. Valves in Insulated Piping:

1. Include 2-inch (50-mm) stem extensions.
2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

I. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port and Bronze or Brass Trim, Threaded Ends:

1. Manufacturers
   a. Conbraco Industries, Inc; Apollo Division
   b. Crane Company; Crane Valve Group; Crane Valves
   c. Crane Company; Crane Valve Group; Jenkins Valves
   d. Crane Company; Crane Valve Group; Stockham Division
   e. DynaQuip Controls
   f. Flow-Tek, Inc
   g. Grinnell Corporation
   h. Hammond Valve
   i. Honeywell Braukmann
   j. Jamesbury, Inc.
   k. Jomar International, LTD.
   l. Kitz Corporation of America.
   m. Legend Valve & Fitting, Inc.
   n. Milwaukee Valve Company.
   o. Nexus Valve Specialties.
   p. Nibco Inc.
   q. R & M Energy Systems (Borger, TX).
   r. Red-White Valve Corp.
   s. Richards Industries; Marwin Ball Valves.
   t. Watts Industries, Inc.; Water Products Div.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 23 0553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

B. Select valves with the following end connections:
   1. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
   2. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.4 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2-1/2 (DN 65) and Smaller: Bronze ball valves, two piece with brass or bronze trim, full port, threaded, solder or press connection-joint ends.

END OF SECTION 23 0523.12

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product indicated.
2. Hangers and Supports:

a. Shop Drawings: Signed and sealed by a qualified professional engineer.
b. Welding certificates.
c. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
d. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hangers and Supports for Plumbing Piping Equipment:

1. Structural Performance: Hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

a. Design supports for multiple pipes capable of supporting combined weight of supported systems and system contents.
b. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
c. Design seismic-restraint hangers and supports for piping and equipment, and obtain approval from authorities having jurisdiction.

2.2 HANGERS AND SUPPORTS FOR HVAC

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Fastener Systems:

1. Verify suitability of fasteners in this article for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick.

2. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pullout, tension, and shear capacities appropriate for supported loads and building materials where used.
3. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pullout, tension, and shear capacities appropriate for supported loads and building materials where used.

C. Miscellaneous Materials:

1. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
2. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

a. Properties: Nonstaining, noncorrosive, and nongaseous.
b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 GENERAL PIPING INSTALLATIONS

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

3.2 HANGERS AND SUPPORTS

A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.

B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.

C. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches (100 mm) thick.

D. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100) to allow off-center closure for hanger installation before pipe erection.
3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).

F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

END OF SECTION 23 05 29

SECTION 23 05 53 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.
5. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Black.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.4 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch (0.8-mm) or stainless steel, 0.025-inch (0.64-mm) or 3/32-inch (2.4-mm) laminated plastic with 2 black surfaces and white inner layer, minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain or beaded chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum.
2. Fasteners: Brass grommet and wire
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety-yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

C. Pipe Label Color Schedule:
1. Heating Water Piping: White letters on a safety-green background.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:
   a. Hot Water: 1-1/2 inches (38 mm), round
   b. Gas: 1-1/2 inches (38 mm), round

2. Valve-Tag Colors:
   a. Hot Water: Red
   b. Gas: Black

3. Letter Colors:
   a. Hot Water: Black
   b. Gas: White

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Certified TAB reports.
2. Documentation of work performed per ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
3. Documentation of work performed per ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

B. TAB Firm Qualifications: AABC, NEBB or TABB certified.

C. TAB Report Forms: Standard TAB contractor's forms approved by Architect.

D. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine the approved submittals for HVAC systems and equipment.

C. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

D. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

E. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

F. Examine automatic temperature system components to verify the following:

1. Dampers and other controlled devices are operated by the intended controller.
2. Dampers are in the position indicated by the controller.
3. Integrity of dampers for free and full operation and for tightness of fully closed and fully open positions.
4. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
5. Sensors are located to sense only the intended conditions.

6. Sequence of operation for control modes is according to the Contract Documents.
7. Controller set points are set at indicated values.
8. Interlocked systems are operating.
9. Changeover from heating to cooling mode occurs according to indicated values.

G. Report deficiencies discovered before and during performance of test and balance procedures.

3.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare schematic diagrams of systems' "as-built" duct layouts.

B. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

C. Verify that motor starters are equipped with properly sized thermal protection.

D. Check for airflow blockages.

E. Check condensate drains for proper connections and functioning.

F. Check for proper sealing of air-handling unit components.

G. Check for proper sealing of air duct system.

3.4 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

END OF SECTION 23 05 93

SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product indicated.
2. For adhesives and sealants, documentation including printed statement of VOC content.

B. Quality Assurance: Labeled with maximum flame-spread index of 25 and maximum smoke-developed index of 50 according to ASTM E 84.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics:

1. Indoor Insulation and Related Materials: To be factory-labeled designating maximum flame-spread index of 25 or less and smoke-developed index of 50 or less according to ASTM E 84.
2. Outdoor Insulation and Related Materials: To be factory labeled designating maximum flame-spread index of 75 or less and smoke-developed index of 150 or less according to ASTM E 84.

2.2 INSULATION MATERIALS

A. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

B. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

C. Mineral-Fiber Blanket Insulation: Comply with ASTM C 553, Type II and ASTM C 1290, Type I.

D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
2. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

G. Factory-Applied Jackets: When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

H. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

I. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

PART 3 - EXECUTION

3.1 INSULATION INSTALLATION

A. Comply with requirements of the Midwest Insulation Contractors Association's "National Commercial & Industrial Insulation Standards" for insulation installation on pipes and equipment.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall, Partition, and Floor Penetrations: Install insulation continuously through penetrations. Seal penetrations. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

D. Flexible Elastomeric Insulation Installation:

1. Seal longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

E. Mineral-Fiber Insulation Installation:

1. Insulation Installation on Straight Pipes and Tubes: Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
3. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by

insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

4. Blanket and Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
5. For ducts and plenums with surface temperatures below ambient, install a continuous, unbroken vapor barrier.

F. Plenums and Ducts Requiring Insulation:

1. Concealed and exposed supply and outdoor air.
2. Concealed and exposed return air located in nonconditioned space.
3. Concealed and exposed exhaust between isolation damper and penetration of building exterior.

G. Plenums and Ducts Not Insulated:

1. Metal ducts with duct liner.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.

H. Piping Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawlspaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.2 DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed duct insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

3.3 HVAC PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall be the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.

END OF SECTION 23 07 00

SECTION 23 09 23.16 - GAS INSTRUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes the Following Gas Instruments:
   1. Multipoint carbon-monoxide monitoring system.

1.3 DEFINITIONS

A. NDIR: Nondispersive infrared.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

   1. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
   2. Installation instructions, including factor affecting performance.
   3. Product description with complete technical data, performance curves, product specification sheets.

B. Shop Drawings:

   1. Include plans, elevations, sections, and mounting details.
   2. Include diagrams for power, signal, and control wiring.
   3. Number-coded identification system for unique identification of wiring, cable, and tubing ends.

C. Samples: For each exposed product installed in finished space.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas instruments to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MULTIPOINT CARBON-MONOXIDE MONITORING SYSTEM

A. Manufactures:
1. ZGARD
2. Building Automation Products
3. MSA Instrument Division

B. Description:

1. Each sampling point shall monitor any variation in the carbon-monoxide concentration level.
2. Each sampling point shall be individually piped to the monitoring system. Each sampling point shall be an alarm point.
3. Sample time shall be adjustable in 1 second increments from zero to 60 minutes.
4. Span and zero calibration gas shall be automatically initiated by the microprocessor. System shall also provide manual initiation of span and zero calibration gas.
5. Analyzer output shall be corrected by the microprocessor.
6. Monitoring system shall have 2 sample points.
7. System shall operate on 120-V ac, single-phase, 60-Hz power.
8. Final adjustment; calibration, testing, and startup of the system shall be performed by a trained representative of manufacturer.

C. Analyzer:

1. Analyzer shall operate using principle of nondispersive infrared absorption.
2. Sampling response time shall be within 10 seconds.
3. Zero drift and span drift shall be less than 1 percent of full scale within a 24-hour period.
4. Repeatability shall be within 1 percent of full scale.
5. Accuracy shall be within 1 percent of full scale.
6. Calibration range shall be zero to 500 ppm.
7. Digital display on analyzer face with scale shall be in ppm.
8. Temperature shall be compensated from 30 to 120 deg F (minus 1 to 49 deg C) ambient temperature.

D. Control and Display:

1. Each sample shall send a 4-20 mA output signal proportional to the highest concentration.
2. Alphanumeric visual display of current analyzer concentration reading shall be in ppm or another industry-accepted measurement.
3. Visual indication for sample analyzing, sample high-concentration alarm, analyzer malfunction, and calibration.
4. Any number and configuration of sample points shall be capable of being bypassed.
5. Each sample point shall be capable of being manually sampled through an override feature.
6. System parameters shall be stored in nonvolatile memory.
7. Provide at least an eight-hour battery backup of current alarm status. Battery shall be rechargeable.

E. Enclosure:

1. NEMA 250, Type 1.
2. Hinged and locking door, full size of face.

3. House all system components. Multiple adjoining enclosures are acceptable if joined to a common support structure.

F. Calibration Equipment:

1. Provide equipment necessary to automatically and manually calibrate the system, including, but not be limited to, the following:

a. Regular assembly.
b. Zero cap.
c. Calibration cap.
d. Two cylinders filled with calibration gas.
e. Instruction book.
f. Carrying case.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.

C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Furnish and install products required to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Properly support instruments, tubing, piping, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to seismic loads.

D. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by using excessive force or oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

E. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

F. Corrosive Environments:

1. Use products that are suitable for environment to which they are subjected.
2. If possible, avoid or limit use of materials in corrosive environments, including but not limited to, the following:
   a. Process exhaust airstreams.

3. When conduit is in contact with a corrosive environment, use Type 316 stainless-steel conduit and fittings or conduit and fittings that are coated with a corrosive-resistant coating that is suitable for environment.
4. Where instruments are located in a corrosive environment and are not corrosive resistant from manufacturer, field install products in a NEMA 250, Type 4X enclosure constructed of Type 316L stainless steel.

3.3 ELECTRICAL POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 26 28 16 "Enclosed Switches and Circuit Breakers."

C. Furnish and install power wiring. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

D. Furnish and install raceways. Comply with requirements in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

3.4 INSTRUMENTS, GENERAL INSTALLATION REQUIREMENTS

A. Mounting Location:

1. Install transmitters for gas associated with individual air-handling units and associated connected ductwork and piping near air-handlings units co-located in air-handling unit system control panel, to provide service personnel a single and convenient location for inspection and service.
2. Install gas switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
3. Mount switches and transmitters not required to be mounted within system control panels on walls, floor-supported freestanding pipe stands, or floor-supported structural support frames. Use manufacturer's mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.

B. Mounting Height:

1. Mount instruments in user-occupied space to match mounting height of light switches unless otherwise indicated on Drawings. Mounting height shall comply with codes and accessibility requirements.
2. Mount switches and transmitters located in mechanical equipment rooms and other similar space not subject to code, state, and federal accessibility requirements within a range of 42 to 72 inches (1.1 to 1.6 m)above the adjacent floor, grade, or service catwalk or platform.

   a. Make every effort to mount at 60 inches (1.5 m).

C. Seal penetrations to ductwork, plenums, and air-moving equipment to comply with duct static-pressure class and leakage and seal classes indicated, using neoprene gaskets or grommets.

3.5 CARBON-MONOXIDE MONITORING SYSTEM

A. Install sample points in monitored area to provide accurate measurement of gas concentration.

B. Install exposed sampling points with a finished appearance consistent with other materials in space. Submit proposed products to be installed for review and approval.

C. Individually install each sample point to the carbon-monoxide monitoring system.

D. Install tubing in a minimum size of NPS 3/8 (DN 10).

E. Use compression fittings at connections to equipment.

F. If not indicated on Drawings, locate carbon-monoxide monitoring system in a secured and serviceable location accessible to authorized personnel.

G. Support carbon-monoxide monitoring system from floor or wall. Support floor-mounted systems using a structural channel frame. Provide mounting brackets.

3.6 CHECKOUT PROCEDURES

A. Check out installed products before continuity tests, leak tests, and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that impact performance.

D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.

3.7 ADJUSTMENT, CALIBRATION, AND TESTING

A. Description:

1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
2. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.
3. For each analog instrument, perform a three-point calibration test for both linearity and accuracy.
4. Equipment and procedures used for calibration shall comply with instrument manufacturer's written recommendations.
5. Provide diagnostic and test equipment for calibration and adjustment.
6. Field instruments and equipment used to test and calibrate installed instruments shall have an accuracy of at least twice the instrument accuracy being calibrated. For

example, an installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.

7. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.
8. If, after calibration, indicated performance cannot be achieved, replace out-of-tolerance instruments.
9. Comply with field-testing requirements and procedures in ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.

B. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.

C. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact.

D. Meters: Check sensors at zero, 50, and 100 percent of Project design values.

E. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

F. Switches: Calibrate switches to make or break contact at set points indicated.

G. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistance source.

3.8 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include t12 months' full maintenance by skilled employees of gas system and equipment Installer or manufacturer's authorized service representative. Include monthly preventive maintenance, repair or replacement of worn or defective components, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain instrumentation and control devices.

END OF SECTION 23 09 23.16

SECTION 23 11 23 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars.
6. Dielectric fittings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Welding certificates.

C. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.9 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

1.10 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 08 31 13 "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.3 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches (1830 mm.)

B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: [40] [60]-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (862 kPa).

C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.4 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.5 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.

1. CWP Rating: [125 psig (862 kPa)] <Insert pressure>.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
5. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig (862 kPa).
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Body: Bronze, complying with ASTM B 584.
2. Ball: Chrome-plated bronze.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE; blowout proof.
5. Packing: Threaded-body packnut design with adjustable-stem packing.

6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig (4140 kPa).
8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Bronze Plug Valves: MSS SP-78.

1. Body: Bronze, complying with ASTM B 584.
2. Plug: Bronze.
3. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Operator: Square head or lug type with tamperproof feature where indicated.
5. Pressure Class: 125 psig (862 kPa).
6. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.

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G. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
10. Maximum Inlet Pressure: Contractor to verify inlet gas pressure and order appropriate type of regulator.

H. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Description:

a. Standard: ASSE 1079.

2.7 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to 54 and the NFPA International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

a. Exception: Tubing passing through partitions or walls does not require striker barriers.

3. Prohibited Locations:

a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."

V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 18 "Escutcheons for HVAC Piping."

3.4 SERVICE-METER ASSEMBLY INSTALLATION

A. Install service-meter assemblies aboveground.

B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.

C. Install strainer on inlet of service-pressure regulator and meter set.

D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.

E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.

F. Install service meters downstream from pressure regulators.

G. Install metal bollards to protect meter assemblies. Comply with requirements in Section 055000 "Metal Fabrications" for pipe bollards.

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.6 PIPING JOINT CONSTRUCTION

3.7 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of appliance connector.

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.8 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

3.9 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (15.8 mm).

3.10 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.11 LABELING AND IDENTIFYING

A. Comply with requirements in Section 23 0553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.12 PAINTING

A. earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel.
d. Color: Yellow.

B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.13 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.14 INDOOR PIPING SCHEDULE

A. Aboveground, branch piping NPS 2 (DN 50)and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

3.15 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be one of the following:

1. Two-piece, full or regular-port, bronze ball valves with bronze trim.
2. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be the following:

1. Two-piece, full or regular-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, non-lubricated plug valve.

END OF SECTION 23 11 23

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIRMENTS

A. Test Pressure for Refrigerant R-410A:

1. Suction Tubing for Refrigeration and Air-Conditioning Applications Other than Heat Pumps: 300 psig.
2. Hot-Gas and Tubing Lines: 535 psig.

B. Test Pressure for Refrigerant R-454B:

1. Suction Tubing for Refrigeration and Air-Conditioning Applications Other than Heat Pumps: 300 psig.
2. Suction Tubing for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Tubing Lines: 535 psig (3689 kPa).

C. Comply with ASME B31.5, "Refrigerant Piping," and with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

2.2 TUBES AND FITTINGS

A. Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B) and ASTM B 280, Type ACR.

B. Wrought-Copper Fittings and Unions: ASME B16.22.

C. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

D. Brazing Filler Metals: AWS A5.8/A5.8M.

2.3 VALVES AND SPECIALTIES

A. Thermostatic Expansion Valve: Comply with ARI 750.

1. Manufacturers:

a. Danfoss Inc.
b. Emerson Climate Technology
c. Heldon Produces
d. Paul Mueller Company

2. Forged brass or steel body, stainless-steel internal parts, copper tubing filled with refrigerant charge for 40 deg F (5 deg C) suction temperature; 700-psig (4820-kPa) working pressure, and 240 deg F (116 deg C) operating temperature.

B. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a Nationally Recognized Testing Laboratory.

1. Manufacturers:
a. Danfoss Inc.
b. Emerson Climate Technology
c. Heldon Produces
d. Paul Mueller Company
e. Parker Hannifin Corp.

2. Plated steel body and bonnet, 240 deg F (116 deg C) temperature rating, 400-psig (2760-kPa) working pressure, 240 deg F (116 deg C) operating temperature; and 24-V, normally closed holding coil.

C. Straight-Type Strainers:

1. Manufacturers:
a. Danfoss Inc.
b. Heldon Produces
c. Parker Hannifin Corp.

2. Welded steel with corrosion-resistant coating and 100-mesh, stainless-steel screen with socket ends; 500-psig (3450-kPa) working pressure and 275 deg F (135 deg C) working temperature.

D. Moisture/Liquid Indicators:

1. Manufacturers:
a. Danfoss Inc.
b. Emerson Climate Technology
c. Heldon Produces
d. Parker Hannifin Corp.

2. Forged brass body, 500-psig (3450-kPa) operating pressure, 240 deg F (116 deg C) operating temperature; with replaceable, polished, optical viewing window and color-coded moisture indicator.

E. Replaceable-Core Filter Dryers: Comply with AHRI 730.

1. Manufacturers:
a. Danfoss Inc.
b. Emerson Climate Technology
c. Heldon Produces
d. Parker Hannifin Corp.
2. Steel shell with ductile-iron cover; 500-psig (3450-kPa) operating pressure; 240 deg F (116 deg C) operating temperature.

F. Permanent Filter Dryers: Comply with AHRI 730.

1. Manufacturers:
   a. Danfoss Inc.
   b. Emerson Climate Technology
   c. Heldon Produces
   d. Parker Hannifin Corp.
   e.
2. Steel shell with ductile-iron cover; 500-psig (3450-kPa) operating pressure; 240 deg F (116 deg C) operating temperature.

2.4 REFRIGERANTS

A. ASHRAE 34, R-134a: Tetrafluoroethane.

B. ASHRAE 34, R-407C: Difluoromethane/Pentafluoroethane/1,1,1,2-Tetrafluoroethane.

C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight.

B. Install refrigerant piping and charge with refrigerant according to ASHRAE 15.

C. Belowground, install copper tubing in PVC conduit. Vent conduit outdoors.

D. Insulate suction lines to comply with Section 230700 "HVAC Insulation."

E. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

F. Install solenoid valves upstream from each thermostatic expansion valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporator coils.

H. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

I. Install strainers upstream from and adjacent to solenoid valves, thermostatic expansion valves, and compressors unless they are furnished as an integral assembly for device being protected.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

3.2 PIPING APPLICATIONS FOR REFRIGERANT R-410A & R-545B

A. Suction Lines: Copper, Type L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines: Copper, Type L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

END OF SECTION 23 2300

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings - single wall.
2. Rectangular ducts and fittings - double wall.
3. Round ducts and fittings - single wall.
4. Round ducts and fittings - double wall.
5. Sheet metal materials.
6. Duct liner.
7. Sealants and gaskets.
8. Hangers and supports.
9. Strut support system for ductwork - metal, cable type.

B. Related Requirements:

1. Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top and bottom of ducts.
5. Dimensions of all duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

Delegated Design Submittals:

12. Sheet metal thicknesses.
13. Joint and seam construction and sealing.
14. Reinforcement details and spacing.
15. Materials, fabrication, assembly, and spacing of hangers and supports.

C. Sustainable Design Submittals:

1. Product Data: For adhesives, mastics, and sealants, indicating VOC content.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Welding certificates.

C. Field quality control reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports are to withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

C. Airstream Surfaces: Surfaces in contact with airstream comply with requirements in ASHRAE 62.1.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and

Equipment," and Section 7 - "Construction and System Startup."

E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

F. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 RECTANGULAR DUCTS AND FITTINGS

A. Rectangular Ducts and Fittings - Single Wall:

1. Manufacturers: Subject to compliance with requirements
2. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on static-pressure class indicated on the Drawings.

    a. Construct ducts of galvanized sheet steel.

3. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

    a. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
    b. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.

4. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
5. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Rectangular Ducts and Fittings - Double Wall:

1. Manufacturers: Subject to compliance with requirements
2. Source Limitations: Obtain double-wall, rectangular ducts and fittings from single manufacturer.
3. Rectangular Ducts: Fabricate ducts with indicated dimensions for clear internal dimensions of the inner duct.
4. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and

Flexible" based on static-pressure class indicated on the Drawings.

a. Construct ducts of galvanized sheet steel.

5. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

   a. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
   b. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.

6. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
7. Interstitial Insulation, Fibrous Glass: Duct liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

   a. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
   b. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
   c. Coat insulation with antimicrobial coating.
   d. Cover insulation with polyester film complying with UL 181, Class 1.

8. Interstitial Insulation, Flexible Elastomeric: Duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.

   a. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

9. Inner Duct: Minimum 24-gauge

2.3 ROUND DUCTS AND FITTINGS

A. Round Ducts and Fittings - Single Wall:

1. Manufacturers: Subject to compliance with requirements,
2. Source Limitations: Obtain single-wall, round ducts and fittings from single manufacturer.
3. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on static-pressure class indicated on the Drawings.
4. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct

Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

5. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
6. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Round Ducts and Fittings - Double Wall:

1. Manufacturers: Subject to compliance with requirements
2. Source Limitations: Obtain double-wall, round ducts and fittings from single manufacturer.
3. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on static-pressure class indicated on the Drawings.

    a. Construct ducts of galvanized sheet steel
    b. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

4. Inner Duct: Minimum 24-gauge
5. Interstitial Insulation, Fibrous Glass: Duct liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

    a. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
    b. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
    c. Coat insulation with antimicrobial coating.
    d. Cover insulation with polyester film complying with UL 181, Class 1.

6. Interstitial Insulation, Flexible Elastomeric: Duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.

    a. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction

methods. Sheet metal materials are to be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: [G60][G90].
2. Finishes for Surfaces Exposed to View: Mill phosphatized.
3. Lockforming Quality: Sheet steel and galvanized coating is to be able to be formed with back-to-back bends in seams such as the Pittsburgh lock at high speed without cracking or flaking of the coating on the outside of the bend.

C. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4-inch- minimum diameter for lengths 36 inches or less; 3/8-inch- minimum diameter for lengths longer than 36 inches.

2.5 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed; SAINT-GOBAIN
b. Johns Manville; a Berkshire Hathaway company
c. Knauf Insulation
d. Owens Corning

2. Source Limitations: Obtain fibrous-glass duct liner from single manufacturer.
3. Maximum Thermal Conductivity:

a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

4. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound is to be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
5. Liner Adhesive: Solvent or Water-based liner adhesive, complying with NFPA 90A or NFPA 90B and with ASTM C916.

a. Adhesive: As recommended by adhesive manufacturer and with a VOC content

of 80 g/L or less.

1) Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
2) Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
3) Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify the building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C534/C534M, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Aeroflex USA
b. Armacell LLC
c. K-Flex USA

2. Source Limitations: Obtain flexible elastomeric duct liner from single manufacturer.
3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

a. Adhesive: As recommended by adhesive manufacturer and with a VOC content of 80 g/L or less.

1) Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
2) Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
3) Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify the building concentration of formaldehyde does not exceed half of the indoor recommended

exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

C. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.

D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm or greater.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.6 SEALANTS AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets are to be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: [3 inches][4 inches][6 inches].
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. Sealant shall have a VOC content of 420 g/L or less.

    a. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
    b. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
    c. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify the building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
9. Service: Indoor or outdoor.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
11. Sealant shall have a VOC content of 420 g/L or less.
12. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
13. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
14. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify the building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

E. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single component, acid curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
8. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
9. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify the building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal is to provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and is to be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

E. Steel Cables for Stainless Steel Ducts: Stainless steel complying with ASTM A492.

F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless Steel Ducts: Stainless steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.

K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation.

L. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

M. Branch Connections: Use lateral or conical branch connections.

N. Installation of Metal, Cable-Type Strut Support System for Ductwork: Install in accordance with manufacturer's written installation instructions.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings,

hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher than 2-Inch wg (500 Pa): Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher than 2-Inch wg (500 Pa): Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC."

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and

Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 ft..

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 INSTALLATION OF SEISMIC-RESTRAINT DEVICES

A. See Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraint installation requirements.

3.6 DUCTWORK CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
3. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. For cleaning of existing ductwork, see Section 230130.52 "Existing HVAC Air Distribution System Cleaning."

C. Use duct cleaning methodology as indicated in NADCA ACR.

D. Use service openings for entry and inspection.

1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

E. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

F. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

G. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.9 STARTUP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

B. Liner:

1. Supply-Air Ducts: Fibrous glass, Type I 1 inch thick.
2. Return-Air Ducts: Fibrous glass, Type I 1 inch thick.

C. Double-Wall Duct Interstitial Insulation:

1. Supply-Air Ducts: 1 inch thick.
2. Return-Air Ducts: 1 inch thick.

D. Elbow Configuration:

1. Rectangular Duct - Requirements for Different Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm (5 m/s) or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two

vanes.

3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm (7.6 m/s) or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct - Requirements for All Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to-Diameter Ratio: 1.5.

b. Round Elbows:

1) Stamped or pleated for [12 inches]<Insert dimension> and smaller diameters.
2) Standing seam for [14 inches]<Insert dimension> and larger diameter.

E. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

b. Rectangular Main to Round Branch: Conical spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Flange connectors.
4. Turning vanes.
5. Duct-mounted access doors.
6. Flexible connectors.
7. Flexible ducts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Exposed-Surface Finish: Mill phosphatized.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Available Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. CESCO Products.
4. Duro Dyne Corp.
5. Greenheck.
6. Penn Ventilation Company, Inc.
7. Prefco Products, Inc.
8. Ruskin Company.
9. Vent Products Company, Inc.

B. Description: Gravity balanced.

C. Frame: Hat-shaped, 0.063-inch- (1.6-mm-) thick extruded aluminum.

D. Blades: Multiple single-piece blades, with sealed edges.

E. Blade Action: Parallel.

F. Blade Seals: Extruded vinyl, mechanically locked or Neoprene, mechanically locked.

G. Bearings: synthetic pivot bushings.

H. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.

2.4 MANUAL VOLUME DAMPERS

A. Available Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. Flexmaster U.S.A., Inc.
4. McGill AirFlow Corporation.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Penn Ventilation Company, Inc.
8. Ruskin Company.
9. Vent Products Company, Inc.

B. Standard, Steel, Manual Volume Dampers:

1. Standard leakage rating.
2. Suitable for horizontal or vertical applications.
3. Frames:

    a. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized 0.064 inch (1.62 mm) thick.
5. Bearings:

    a. Molded synthetic.
    b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

6. Tie Bars and Brackets: Galvanized steel.

2.5 FLANGE CONNECTORS

A. Description: factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

2.6 FLEXIBLE CONNECTORS

A. Available Manufacturers:

1. Ductmate Industries, Inc.

2. Duro Dyne Corp.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches (146 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

2.7 FLEXIBLE DUCTS

A. Available Manufacturers:

1. Flexmaster U.S.A., Inc.
2. Hart & Cooley, Inc.
3. McGill AirFlow Corporation.
4. Thermaflex

B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, to suit duct size.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Connect ducts to duct silencers rigidly.

H. Install flexible connectors to connect ducts to equipment.

I. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

J. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

K. Connect diffusers or light troffer boots to ducts with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.

L. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

M. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 34 23 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Products shall be licensed to use the AMCA-Certified Ratings Seal.

B. Power ventilators shall comply with UL 705.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 CENTRIFUGAL ROOF VENTILATORS

A. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.
1. Overall Height: 18 inches (450 mm).
2. Pitch Mounting: Manufacture curb for roof slope.
3. Mounting Pedestal: Galvanized steel with removable access panel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units with clearances for service and maintenance.

B. Ground power ventilators.

END OF SECTION 23 34 23

SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product indicated, including color charts for factory finishes.

PART 2 - PRODUCTS

2.1 DIFFUSERS

A. Rectangular and Square Ceiling Diffusers

1. Manufacturers
   a. Titus
   b. Price
   c. Krueger

2. Material: Aluminum.
3. Finish: Baked enamel, white
4. Mounting: T-bar

B. Louver Face Diffuser

1. Manufacturers
   a. Titus
   b. Price
   c. Krueger

2. Material: Aluminum.
3. Finish: Baked enamel, white
4. Mounting: Duct connection

C. Louver Face Diffuser

1. Manufacturers
   a. Titus
   b. Price
   c. Krueger

2. Material: Aluminum.
3. Finish: Baked enamel, white
4. Mounting: Surface

2.2 REGISTERS AND GRILLES

A. Egg Crate Grille:

1. Manufacturers
   a. Titus
   b. Price
   c. Krueger

2. Material: Aluminum.
3. Finish: Baked enamel, white
4. Mounting: T-bar

B. Louver Face Grille:

1. Manufacturers
   a. Titus
   b. Price
   c. Krueger

2. Material: Aluminum.
3. Finish: Baked enamel, white
4. Mounting: Surface

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel unless otherwise indicated. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

SECTION 23 54 16.13 - GAS-FIRED FURNACES

PART 1 - General

1.1 Section requirements

A. Submittals:

1. Product data: for each type of product.
2. Documentation indicating that units comply with ashrae 62.1, section 5 - "systems and equipment."
3. For solvent cements and adhesive primers, documentation including printed statement of voc content.

B. Warranties: submit a written warranty executed by manufacturer agreeing to repair or replace furnaces that fail in materials or workmanship within 10 years from date of substantial completion.

1.2 Quality assurance

A. ASHRAE/IES 90.1 compliance: applicable requirements in ASHRAE/IES 90.1, section 6 - "heating, ventilating, and air-conditioning."

B. Comply with NFPA 70.

PART 2 - Products

2.1 Gas-fired furnaces, condensing

A. Factory assembled, piped, wired, and tested; complying with ANSI z21.47/CSA 2.3 and NFPA 54.

1. Type of gas: natural.
2. Fan motor: multispeed.
3. Ignition: electronic pilot ignition.
4. Heat exchanger: aluminized steel.
5. Venting: power, with combustion-air intake duct.
6. Burner controls: thermocouple sensor, flame rollout switch, vent safety shutoff sensor, and limit control.
7. Automatic controls: solid-state board to delay fan start and shutdown.
8. Configuration: upflow
9. Accessories: fan thermal switch and ventilation-air heat exchanger.

B. Capacities and characteristics: see drawings

2.2 Thermostats

A. Controls shall comply with requirements in ASHRAE/IES 90.1, "controls."

B. solid-state thermostat: wall-mounted, programmable, microprocessor-based unit with automatic switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, vacation mode, and battery backup protection against power failure for program settings.

C. Single-stage, heating-cooling thermostat: adjustable, heating-cooling, wall-mounted unit with fan on-automatic selector.

2.3 air filters

A. Disposable filters: 1-inch- (25-mm-) thick fiberglass media with ASHRAE 52.2 minimum efficiency reporting value rating of 6 or higher, in sheet metal frame.

2.4 Refrigeration components

A. General refrigeration component requirements:

1. refrigeration compressor, coils, and specialties shall be designed to operate with cfc-free refrigerants.
2. Energy efficiency: equal to or greater than prescribed by ASHRAE/IES 90.1.

B. Refrigerant coil: copper tubes mechanically expanded into aluminum fins. Comply with AHRI 210/240. Match size with furnace. Include condensate drain pan with accessible drain outlet.

1. Refrigerant coil enclosure: steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet.

C. Refrigerant line kits: annealed-copper suction and liquid lines factory cleaned, dried, pressurized, and sealed, and with suction line insulated. Provide in standard lengths for installation without joints, except at equipment connections.

D. Refrigerant piping: comply with requirements in section 23 2300 "refrigerant piping."

PART 3 - Execution

3.1 Installation

A. Install and connect gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.

B. Connect condensate drains to indirect waste using pvc drainage piping. Extend to nearest equipment drain or floor drain. Construct vented, deep trap at connection to drain pan, and install cleanouts at changes in direction. Terminate to suit local code requirements.

C. Base-mounted units: secure units to substrate. Provide optional bottom closure base if required by installation conditions.

D. Controls: install thermostats and humidistats at mounting height of 60 inches (1500 mm) above floor.

E. Install ground-mounted, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base; 4 inches (100 mm) larger on each side than unit. Concrete, reinforcement, and formwork are specified in section 033000 "cast-in-place concrete." install ground-mounted compressor-condenser components on pe mounting base.

3.2 Connections

A. Gas piping installation requirements are specified in section 23 1123 "facility natural-gas piping." drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Water piping installation requirements are specified in section 22 1116 "domestic water piping." drawings indicate general arrangement of piping, fittings, and specialties. Connect water piping with union and ball valve.

D. Vent and outside-air connection, condensing, gas-fired furnaces: connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.

E. Connect ducts to furnace with flexible connector.

F. Comply with requirements in section 23 2300 "refrigerant piping" for installation and joint construction of refrigerant piping.

3.3 Adjusting

A. Adjust initial-temperature and humidity set points.

B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

3.4 Demonstration

A. Train owner's maintenance personnel to adjust, operate, and maintain condensing units.

End of Section 23 54 16.13

SECTION 23 55 23.13 - LOW-INTENSITY, GAS-FIRED, RADIANT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes low-intensity, gas-fired, forced draft, radiant tube heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Signed, sealed, and prepared by or under the supervision of a qualified professional engineer.
2. Include plans, elevations, sections, and mounting details.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
4. Detail fabrication and assembly of high-intensity, gas-fired, radiant heaters, as well as procedures and diagrams.
5. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas-fired, radiant heaters to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Igniter: One hot-surface burner igniter(s) for each style of high-intensity, gas-fired, radiant heater furnished.

1.7 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of radiant heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Period: All warranty periods listed below are from date of Substantial Completion.

a. Burner Assembly: Three years.
b. Combustion and Emitter Tubes: Five years.
c. Heater Controls: Three years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. CSA certified, with CSA Seal and certification number clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.

B. UL listed and labeled, with UL label clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 FORCED-DRAFT HEATERS

A. Basis of Design Product: Superior Radiant or comparable product by one of the following:
1. Reverber Ray - Detroit Radiant

B. Description: Factory-assembled, indoor, overhead-mounted, electrically controlled, low-intensity, infrared radiant heating units using gas combustion. Heater to have all necessary factory-installed wiring and piping required prior to field installation and startup.

C. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

D. Burner Assembly:
1. Combustion-Air Inlet: Ducted horizontal to outdoors through sidewall with vent caps.
2. Burner Control Housing: Corrosion-resistant, aluminized steel.

a. Totally enclosed with steel access cover.
b. Sight glass for visual inspection of burner.
c. Finish: powder-coated finish.

3. Burner: chrome plated steel.
4. Ignition System: Direct spark 24/25-V ac with flame rod sensing capabilities and self-diagnostic control module.

5. Combustion Blower Fan: Dynamically balanced, direct-driven, forward-curved fan with cast-aluminum-alloy impeller and steel housing, with a minimum temperature rating of 450 deg F (232 deg C).
6. Motors: General requirements for motors are specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."

    a. Motor: Resilient-mounted, capacitor-start-capacitor-run type with sealed ball bearings; totally enclosed, nonventilated type with internal thermal protection.
    b. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

E. Combustion Chamber: 4-inch- (100-mm-) diameter, 16-gage, aluminized-steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish. Chambers shall be equipped with sight glass for burner and pilot flame observation.

F. Emitter Tube: 4-inch- (100-mm-) diameter, 16-gage, aluminized-steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish. Emitter tubing shall be equipped with baffles to maximize heating efficiency.

1. Tubing Connections: Compression couplings made from aluminized or stainless steel.
2. Exhaust Vent Termination: Horizontal though side wall with vent caps.

G. Reflector: Polished aluminum, with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Reflectors or entire heater shall accommodate rotational adjustment from horizontal to a minimum 30-degree tilt from vertical.

H. Accessories:

1. Stainless-steel flexible connector with manual valve for gas supply.
2. Hanger chain with "S" hooks.
3. 3/16-inch- (5-mm-) diameter, chrome plated wire tubing hangers and reflector supports.
4. Clearance warning plaque.

2.3 CONTROLS AND SAFETIES

A. Gas Control Valve: Two-stage, regulated redundant 24-V ac gas valve that contains pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

B. Failure Safeguards: 100 percent shutoff of gas flow in the event of flame or power failure.

C. Prepurge of 30 seconds of air control system prior to burner ignition.

D. Safety lockout of burner after three consecutive ignition failures.

E. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.

F. Control Panel Interlock: Stops burner if panel is open.

G. Indicator Lights: "Airflow-on" and "burner-on" indicator lights.

H. Thermostat: Two-stage, wall-mounted type with 50 to 90 deg F (10 to 32 deg C) operating range and fan on switch.

1. Control Transformer: Integrally mounted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine structures, substrates, areas and conditions, with Installer present, for compliance with requirements for installation tolerances, required clearances, and other conditions affecting performance of the Work.

B. Examine roughing-in for fuel-gas piping to verify actual locations of piping connections before equipment installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Installation: Install gas-fired, radiant heaters and associated gas features and systems according to NFPA 54.

B. Suspended Units: Suspend from substrate using chain hanger kits and building attachments.
1. Comply with requirements for hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

C. Maintain manufacturers' recommended clearances for combustibles.

3.3 CONNECTIONS

A. Gas Piping: Comply with Section 23 11 23 "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.

1. Gas Connections: Connect gas piping to radiant heaters according to NFPA 54.

B. Where installing piping adjacent to gas-fired, radiant heaters, allow space for service and maintenance.

C. Electrical Connections: Comply with applicable requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

1. Install electrical devices furnished with heaters but not specified to be factory mounted.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Verify bearing lubrication.
3. Verify proper motor rotation.
4. Test Reports: Prepare a written report to record the following:

a. Test procedures used.
b. Test results that comply with requirements.
c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Gas-fired, radiant heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial-temperature set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain gas-fired, radiant heaters.

END OF SECTION 23 55 23.13

SECTION 23 72 23.19 – PACKAGED INDOOR FIXED PLATE ENERGY RECOVERY UNITS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the contract, including general and supplementary conditions

1.2 Summary

A. Section includes:
   1. Fixed-plate, total heat exchangers in packaged, indoor, energy-recovery units.

1.3 Action submittals

A. Product data: for each type of product.

   1. Include packaged, indoor, fixed-plate, energy-recovery unit rated capacities, operating characteristics, furnished specialties, and accessories.
   2. Fans:

      a. Certified fan-performance curves with system operating conditions indicated.
      b. Certified fan-sound power ratings.
      c. Fan construction and accessories.
      d. Motor ratings, electrical characteristics, and motor accessories.

B. Shop drawings: for packaged, indoor, fixed-plate, energy-recovery units.

   1. Include plans, elevations, sections, details, and mounting and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

1.4 Closeout submittals

A. Operation and maintenance data: for air-to-air energy recovery equipment to include in maintenance manuals.

1.5 Maintenance material submittals

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Filters: one set(s) of each type of filter specified.

1.6 Coordination

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 Warranty

A. Special warranty: manufacturer agrees to repair or replace components of packaged, indoor, fixed-plate, energy-recovery units that fail in materials or workmanship within specified warranty period.

1. Warranty period for packaged energy-recovery units: two years.
2. Warranty period for fixed-plate total heat exchangers: 10 years.

PART 2 - PRODUCTS

2.1 performance requirements

A. NFPA compliance: comply with NFPA 90a for design, fabrication, and installation of air-handling units and components.

B. ASHRAE compliance:

1. Applicable requirements in ASHRAE 62.1.
2. Capacity ratings for fixed-plate energy-recovery units shall comply with ASHRAE 84.

C. ASHRAE/IES 90.1 compliance: applicable requirements in ASHRAE/IES 90.1.

D. UL compliance:

1. Packaged heat-recovery ventilators shall comply with requirements in UL 1812 or UL 1815.
2. Electric coils shall comply with requirements in UL 1995.

2.2 capacities and characteristics

A. type: fixed-plate total energy-recovery unit.

B. Exhaust air: see drawings

C. Supply air: see drawing

2.3 Packaged, indoor, fixed-plate, sensible energy-recovery units

A. Source limitations: obtain from single source from single manufacturer.

B. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. housing: manufacturer's standard construction with corrosion-protection coating and exterior finish, hinged access doors with neoprene gaskets for inspection and access to internal parts,

minimum 1- (25-) inch- (mm-) thick, 4.3 thermal insulation, knockouts for electrical and piping connections, exterior drain connection, and lifting lugs.

D. Fixed-plate total heat exchanger:

1. Air-to-air energy recovery ventilator shall be fully assembled and consist of a fixed-plate cross-flow heat exchanger

E. Supply and exhaust fans: forward-curved centrifugal fan.

1. motors and drives: direct driven.

a. comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in section 23 051 3 "common motor requirements for HVAC equipment."
b. Motor sizes: minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

F. Filters:

1. Particulate air filtration is specified in section 23 41 00 "particulate air filtration."

G. Filters:

1. Description: flat, pleated factory-fabricated, self-supported, disposable air filters with holding frames.
2. UL compliance: comply with UL 900.
3. Media: interlaced glass fibers sprayed with nonflammable adhesive.
4. Filter-mounting frames: arranged with access doors or panels on both sides of unit. Filters shall be removable from one side or lift out from access plenum.

2.4 Controls

A. Control panel: solid-state, programmable, microprocessor-based control unit for wall mounting.

B. Dirty filter switch.

C. Low-voltage transformer: integral transformer to provide control voltage to unit from primary incoming electrical service.

2.5 Source quality control

A. Electrical components, devices, and accessories: listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. AHRI compliance: capacity ratings for air-to-air energy-recovery equipment certified as complying with AHRI 1060 (AHRI 1061).

C. Fan performance rating: comply with AMCA 211 and label fans with AMCA-certified rating seal. Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency according to AMCA 210/ASHRAE 51.

D. Fan sound ratings: comply with AMCA 301 or AHRI 260 (IP). Air-handling unit fan sound ratings shall comply with AMCA 301 or AHRI 260 (IP).

E. UL compliance:

1. Packaged fixed plate energy recovery units shall comply with requirements in UL 1812; or UL 1815.
2. Electric coils: comply with UL 1995.

PART 3 - EXECUTION

3.1 Examination

A. Examine areas and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

B. Examine casing insulation materials and filter media before packaged, indoor, fixed-plate, energy-recovery unit installation. Replace with new insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

A. Install packaged, indoor, fixed-plate, energy-recovery units, so supply and exhaust airstreams flow in opposite directions.

1. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to interior components.
2. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.
3. Access doors and panels are specified in section 23 33 00 "Air Duct Accessories."

B. Equipment mounting:

1. install packaged, indoor, fixed-plate, energy-recovery units on 4- (100-) inch (mm) cast-in-place concrete equipment bases

C. install units with clearances for service and maintenance.

D. do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

3.3 Ductwork connections

A. Comply with requirements for ductwork according to section 23 31 00 "Hvac Ducts And Casings."

B. Connect duct to units with flexible connections. Comply with requirements in section 23 33 00 "Air Duct Accessories."

3.4 Electrical connections

A. Install electrical devices furnished with units but not factory mounted.

B. Connect wiring according to section 26 05 19 "Low-Voltage Electrical Power Conductors And Cables."

C. Ground equipment according to section 26 05 26 "Grounding And Bonding For Electrical Systems."

D. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

3.5 Control connections

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to section 26 05 23 "Control-Voltage Electrical Power Cables."

3.6 Field quality control

A. Testing agency: owner will engage a qualified testing agency to perform tests and inspections.

B. Testing agency: engage a qualified testing agency to perform tests and inspections.

C. manufacturer's field service: engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. perform tests and inspections.

E. Tests and inspections:

1. Operational test: after electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Packaged, indoor, fixed-plate, energy-recovery units will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.7 Startup service

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 Adjusting

A. Adjust moving parts to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature and humidity setpoints.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.9 Demonstration

A. Train personnel to adjust, operate, and maintain air-to-air energy-recovery units.

End of section 23 72 23.19

SECTION 23 73 33.16 - INDOOR, INDIRECT, GAS-FIRED HEATING AND VENTILATING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Indoor, indirect, gas-fired heating and ventilating units.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each indoor, indirect, gas-fired heating and ventilating unit.

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
b. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
c. Include unit dimensions and weight.
d. Include cabinet material, metal thickness, finishes, insulation, and accessories.
e. Fans:

1) Include certified fan-performance curves with system operating conditions indicated.
2) Include certified fan-sound power ratings.
3) Include fan construction and accessories.
4) Include motor ratings, electrical characteristics, and motor accessories.
5) Include fan speed controllers.

f. Include material thickness and finishes, including color charts.
g. Include filters with performance characteristics.
h. Include direct, gas-fired burners with performance characteristics.
i. Include dampers, including housings, linkages, and operators.

B. Sustainable Design Submittals:

1. Product data showing compliance with ASHRAE 62.1.
2. Product Data: For air filtration performance.
3. Product Data: For adhesives, mastics, and sealants, indicating VOC content.
4. Laboratory Test Reports: For adhesives, mastics, and sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For each type and configuration of indoor, indirect, gas-fired heating and ventilating unit.

1. Include plans, elevations, sections, and mounting or attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of gas-fired heating and ventilating units, as well as procedures and diagrams.
4. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's warranty.

B. Startup service reports.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For indirect, gas-fired heating and ventilating units to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) for each unit.
2. Gaskets: One set(s) for each access door.
3. Fan Belts: One set(s) for each unit.

1.6 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of indirect, gas-fired heating and ventilating units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Entire Unit: Manufacturer's standard, but not less than one year(s) from date of Substantial Completion.
2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of units and components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.2 CAPACITIES AND CHARACTERISTICS (SEE SCHEDULE ON DRAWINGS)

2.3 INDOOR, INDIRECT, GAS-FIRED HEATING AND VENTILATING UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Greenheck Fan Corporation
2. Modine Manufacturing Company
3. REZNOR, a brand of Nortek Global HVAC
   Sterling HVAC Products; a Mestek company
4. Trane

B. Unit Casings:

1. General Fabrication Requirements for Casings:

   a. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
   b. Casing Joints: Sheet metal screws or pop rivets, factory sealed with water-resistant sealant.
   c. Heating and Ventilating Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.

2. Configuration: Horizontal unit with horizontal discharge for suspended installation.
3. Single-Wall Construction:

   a. Material: Galvanized-steel or aluminized-steel with manufacturer's standard finish.
   b. Floorplate: Galvanized steel, minimum 18 gauge thick.

4. Panels, Doors, and Windows:

a. Panels:

1) Fabrication: Formed and reinforced, with same materials and insulation thickness as casing.
2) Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against airflow.
3) Gasket: Neoprene, applied around entire perimeters of panel frames.
4) Size: Large enough to allow unobstructed access for inspection and maintenance of unit's internal components.

b. Doors:

1) Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
2) Hinges: A minimum of two ball-bearing hinges or stainless steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against airflow. Provide safety latch retainers on doors so that doors do not open uncontrollably.
3) Gasket: Neoprene, applied around entire perimeters of panel frames.
4) Size: Large enough to allow unobstructed access for inspection and maintenance of unit's internal components.

c. Locations and Applications:

1) Fan Section: Inspection and access panels or doors.
2) Access Section: Inspection and access panels or doors.
3) Gas-Fired Burner Section: Inspection and access panels or doors.
4) Damper Section: Inspection and access panels or doors.
5) Filter Section: Inspection and access panels or doors large enough to allow periodic removal and installation of filters.
6) Mixing Section: Inspection and access panels or doors.

C. Fan, Drive, and Motor:

1. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
2. Fans: Centrifugal, rated according to AMCA 210; galvanized steel; mounted on solid-steel shaft.

a. Shafts: With field-adjustable alignment.
b. Shaft Bearings: Heavy-duty, self-aligning, permanently lubricated ball bearings][, pillow-block bearing with an L50 rated life of 100,000 hours according to ABMA 9.
c. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
d. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 1 inch.
e. Shaft Lubrication Lines: Extended to a location outside the casing.
f. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches wide, attached to two strips of minimum 2-3/4-inch- wide by 0.028-inch- thick, galvanized-steel sheet.

1) Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.

3. Drive: Factory-mounted V-belt drive, with adjustable alignment and belt tensioning, and with 1.25 service factor based on fan motor.

a. Pulleys: Cast iron or cast steel with split, tapered bushing, dynamically balanced at the factory.
b. Belts: Oil resistant, non-sparking and nonstatic; in matched sets for multiple-belt drives.
c. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.146-inch-thick, 3/4-inch diamond-mesh wire screen, welded to steel angle frame; prime coated.

4. Motors:

a. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment"

D. Air Filtration:

1. Panel Filters:

a. Description: Pleated factory-fabricated, self-supported, disposable air filters with holding frames.
b. Filter Unit Class: UL 900.
c. Media: Interlaced glass, synthetic, or cotton fibers coated with nonflammable adhesive and antimicrobial coating.

E. Dampers:

1. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage.

F. Indirect-Fired Gas Burner:

1. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.
2. CSA Approval: Designed and certified by and bearing label of CSA.
3. Burners: Stainless steel.

a. Fuel: Natural gas.
b. Ignition: Electronically controlled electric spark with flame sensor.
c. Gas Control Valve: Two stage.
d. Gas Train: Regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, electronic-modulating temperature control valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

e. High-Altitude Model Kit: For Project elevations more than 2000 ft. above sea level.

4. Venting, Power: Power vented, with integral, motorized centrifugal fan interlocked with gas valve.
5. Combustion-Air Intake: Separate combustion-air intake and vent terminal assembly.
6. Heat Exchanger: Stainless steel.
7. Heat-Exchanger Drain Pan: Stainless steel.
8. Safety Controls:

a. Gas Manifold: Safety switches and controls complying with ANSI standards
b. Vent Flow Verification: Differential pressure switch to verify open vent][Flame rollout switch.
c. High Limit: Thermal switch or fuse to stop burner.
d. Purge-period timer shall automatically delay burner ignition and bypass low-limit control.
e. Airflow Proving Switch: Differential pressure switch senses correct airflow before energizing pilot.
f. Automatic-Reset, High-Limit Control Device: Stops burner and closes main gas valve if high-limit temperature is exceeded.
g. Safety Lockout Switch: Locks out ignition sequence if burner fails to light after three tries. Controls are reset manually by turning the unit off and on.
h. Control Transformer: 24 V ac.

G. Unit Control Panel:

1. Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote control panel.
2. Control Panel: Surface-mounted remote panel, with engraved plastic cover, and the following lights and switches:

a. On-off-auto fan switch.
b. Heat-vent-off switch.
c. Supply-fan operation indicating light.
d. Heating operation indicating light.
e. Thermostat.
f. Damper position potentiometer.
g. Dirty-filter indicating light operated by unit-mounted differential pressure switch.
h. Safety-lockout indicating light.

H. Controls:

1. Control Devices:

a. Remote Thermostat: Adjustable room thermostat with temperature readout.
b. Ionization-Type Smoke Detectors:

1) 24 V dc, nominal.
2) Self-restoring.
3) Plug-in arrangement
4) Integral visual-indicating light.
5) Sensitivity that can be tested and adjusted in place after installation.

6) Integral addressable module.
7) Remote controllability.
8) Responsive to both visible and invisible products of combustion.
9) Self-compensating for changes in environmental conditions.
10) Located in supply[and return] air, shall stop fans when the presence of smoke is detected.

2. Fan Control, Interlocked: Fan to start automatically with exhaust fan(s) to which this heating and ventilating unit is associated for makeup air.
3. Mixed Outdoor- and Return-Air Damper Control: When fan is running, outdoor- and return-air dampers shall modulate to supply minimum outdoor air as follows:

a. Outdoor-air quantity adjusted by potentiometer on control panel.

4. Temperature Control:

a. Operates gas valve to maintain discharge-air temperature with factory-mounted sensor in blower outlet.
b. Operates gas valve to maintain space temperature with wall-mounted, field-wired sensor and adjustment on remote-control panel.
c. Timer shall select remote setback thermostat to maintain space temperature at 50 deg F

2.4 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of indirect-fired heating and ventilating units.

B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of

connections before equipment installation.

C. Verify cleanliness of airflow path to include inner-casing surfaces, filters, coils, turning vanes, fan wheels, and other components.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF INDOOR, INDIRECT, GAS-FIRED HEATING AND VENTILATING UNITS

A. Suspended Units: Suspend units from structural-steel support frame using threaded steel rods and spring hangers. Coordinate sizes and locations of structural-steel support members with actual equipment provided. Comply with requirements for vibration isolation devices specified in

1. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

B. Install gas-fired units in accordance with NFPA 54.

C. Install controls and equipment shipped by manufacturer for field installation with indirect, gas-fired heating and ventilating units.

3.3 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Gas Piping: Comply with requirements in Section 23 11 23 "Facility Natural-Gas Piping." Connect gas piping with shutoff valve and union and with sufficient clearance for burner removal and service. Make final connections of gas piping to unit with corrugated, stainless steel tubing flexible connectors complying with ANSI LC 1/CSA 6.26 equipment connections.

B. Where installing piping adjacent to heating and ventilating units, allow space for service and maintenance.

3.4 DUCTWORK CONNECTIONS

A. Connect supply and return ducts to indirect, gas-fired heating and ventilating units with flexible duct connectors. Comply with requirements in Section 23 33 00 "Air Duct Accessories" for flexible duct connectors.

3.5 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.6 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

3.7 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

a. Inspect for visible damage to burner combustion chamber.
b. Inspect casing insulation for integrity, moisture content, and adhesion.
c. Verify that clearances have been provided for servicing.
d. Verify that controls are connected and operable.
e. Verify that filters are installed.
f. Purge gas line.
g. Inspect and adjust vibration isolators
h. Verify bearing lubrication.
i. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
j. Adjust fan belts to proper alignment and tension.

B. Start unit according to manufacturer's written instructions.

1. Complete startup sheets and attach copy with Contractor's startup report.
2. Inspect and record performance of interlocks and protective devices; verify sequences.
3. Operate unit for run-in period recommended by manufacturer.
4. Perform the following operations for both minimum and maximum firing and adjust

burner for peak efficiency:

a. Measure gas pressure at manifold.
b. Measure combustion-air temperature at inlet to combustion chamber.
c. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

5. Calibrate thermostats.
6. Adjust and inspect high-temperature limits.
7. Inspect dampers, if any, for proper stroke and interlock with return-air dampers.
8. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
9. Measure and record airflow. Plot fan volumes on fan curve.
10. Verify operation of remote panel, including pilot-operation and failure modes. Inspect the following:

a. High-limit heat.
b. Alarms.

11. After startup and performance testing, change filters, verify bearing lubrication, and adjust belt tension.
12. Verify drain-pan performance.
13. Verify outdoor-air damper operation.

3.8 ADJUSTING

A. Adjust initial temperature set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.9 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections

1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties.

D. Units will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.11 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain heating and ventilating units.

END OF SECTION 23 73 33.16

SECTION 23 74 21 – VEHICLE EXHAUST SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Overhead Vehicle exhaust equipment, including hose reels and tailpipe connectors.
   2. Vehicle exhaust system fan, roof mounted.
   3. Interconnecting exhaust ducts.

1.3 SUBMITTALS

A. Product Data: Submit product data for all items

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with applicable SMACNA standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
   1. Fume-a-Vent
   2. Monoxivent
   3. Nederman
   4. Plymovent
   5. Ventaire

2.2 OVERHEAD VEHICLE EXHAUST EQUIPMENT

A. Scope

1. This specification sets forth the requirements for the purchase of an overhead exhaust system to extract exhaust fumes from vehicles to be exhausted to the exterior of the facility.

    a. Equipment shall be new, furnished with all specified materials for installation when delivered. Used or reconditioned equipment will not be accepted
    b. Equipment shall comply with all Federal, State and Local safety regulations, codes and standards.
    c. The application is a public high school vocational shop class. Vehicles will be limited to personal use type cars and trucks, or similar size vehicles. The shop will not handle fleet vehicles, commercial vehicles or larger diesel engine vehicles. There is not space to accommodate larger vehicles in the service bays.

B. Equipment

1. Tail Pipe Adapters
    a. Standard tail pipe adaptor to have a spring loaded isolation flap, oval or round configuration, optional hook chain and should be sized to match the connecting hose. The adapters shall be designed to not slide out of place when in use.
    b. "Y-type" tail pipe adapters (for dual tail pipes) are to be provided in each space that contains an overhead vehicle exhaust system. Adapter to be size to match hose size on hose reels. Provide dual exhaust "Y" adapter, for not less than 50% of the hose reels.

2. Ceiling Mounted Hose Reels
    a. Hose reel shall be a mechanical spring recoil hose reel made of steel.
    b. Hose reel shall have "crushproof" style exhaust hose. Exhaust hose shall be 4" in diameter x minimum 24' in length. Provided with a hose stop and terminated with tailpipe adapter. Hose shall resist kinking and collapsing and return to its original shape after being crushed or compressed. Hose shall be rated for a minimum of 600 degrees F.
    c. Hose reel shall have a durable, stove-enameled finish in the manufacturer's standard color.

3. Exhaust Piping
    a. Provide exhaust system piping rated for the operating temperatures and pressures of the vehicle tail pipe exhaust system.
    b. Minimum 22 gage round quick fit duct system. Galvanized steel construction. Clamping bands with elastomer gasket, for quick unsnap removal. Nordfab style piping and fittings.
    c. Provide from reel outlets through exhaust blower outlet on roof.

4. Exhaust Blower
    a. Include a inline exhaust blower and motor, for indoor mounting.
    b. The system operating static pressure requirement shall be determined by the supplier. See the drawings for proposed duct arrangement and location of shop maintenance bays.
    c. Include weather tight disconnect switch.

5. System Control Panel and Power

a. Provide a local standalone blower and system control panel. The panel shall have the following features and components:
   1) Motor starter or contactor.
   2) Remote start/stop station for operation near the instructor office area.
   3) System in operation status lights.
   4) Designed for 480 volt, 3 phase power supply. Local panel disconnect. Control power transformer. Factory assembled in a general purpose enclosure.
   5) Provide terminals for a remote shutdown through the BAS during unoccupied hours, to prevent unintended operation, or for timed override operation.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel.

C. Provide steel angles or uni-strut style mounting hardware for supporting hose reels from building bar joists at proper vehicle service locations. Design supports for hose reels, for a minimum load of 300#. Supports must be galvanized or painted. Touch up after installation. Welding to bar joists is permitted to secure in position, but spanning members shall be mounted on top of the lower joist chord.

D. Provide test holes at fan inlets and outlets and elsewhere as required to confirm proper performance.

E. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

F. Install overhead vehicle exhaust and exhaust systems in accordance with manufacturer's installation instructions.

3.2 ADJUSTING

A. Adjust the Vehicle Exhaust System as needed, for proper operation. Replace any parts that prevent the system from operating properly.

3.3 CLEANING

A. Remove all debris caused by installation. Clean all exposed surfaces to as fabricated condition and appearance.

3.4 MANUFACTURER'S COMMISSIONING

A. Provide complete startup and commissioning of the completely assembled system. Submit a startup report. Document all settings and adjustments. Document all system checks and verifications.

3.5 DEMONSTRATION / TRAINING

A. Provide the end user a minimum of one hour of hands-on demonstration and operation of the exhaust system and related equipment.

3.6 WARRANTY

A. Provide a written warrantee for a period of one year from date of certificate of occupancy.

END OF SECTION 23 74 21

SECTION 23 81 26 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: One year from date of Substantial Completion.
b. For Parts: One year from date of Substantial Completion.
c. For Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

A. Manufacturers:
   1. Mitsubishi
   2. Daikin
   3. Samsung

2.2 INDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Wall-Mounted, Evaporator-Fan Components:

   1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
   2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110..
   3. Fan: Direct drive, centrifugal.
   4. Fan Motors:

      a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
      b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
      c. Enclosure Type: Totally enclosed, fan cooled.
      d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
      e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
      f. Mount unit-mounted disconnect switches on exterior of unit.

   5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.3 OUTDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

   1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
   2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

      a. Compressor Type: Scroll.
      b. Refrigerant: R-410A.
      c. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
   3. Fan: Aluminum-propeller type, directly connected to motor.
   4. Motor: Permanently lubricated, with integral thermal-overload protection.
   5. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
   6. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

2.5 CAPACITIES AND CHARACTERISTICS – SEE DRAWINGS

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 8126

SECTION 26 00 00 - ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 EXECUTION OF THE WORK

A. These Specifications call out certain duties of the Electrical Contractor and/or Subcontractors. They are not intended as a material list of items required by the Contract.

B. This division of the Specifications covers the electrical systems of the project. It includes work performed by the electrical trades as well as trades not normally considered as electrical trades.

C. Provide all items and work indicated on the Drawings and all items and work called for in this division of the Specifications in accordance with the conditions of Contract (Division 1 General Requirements Documents). This includes all incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor, consumable items, fees, licenses, etc., necessary to provide complete systems. Perform start-up and checkout on each item and system to provide fully operable systems.

D. Comply with all provisions of the Contract Documents including (Division 1), (General Conditions, and Supplementary General Conditions) of the Specifications.

E. Certain terms such as "shall, provide, install, complete, start up" are not used in some parts of these Specifications. This does not indicate that the items shall be less than completely installed or that systems shall be less than complete.

F. Examine and compare the Electrical Drawings and Specifications with the Drawings and Specifications of other trades, and report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the work. At time of bid the most stringent requirements must be included in said bid. Install and coordinate the electrical work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interferences in a manner approved by the Engineer. All changes required in the work of the Contractor caused by neglect shall be corrected at the expense of the Contractor.

G. It is the intent of the Drawings and Specifications to provide a complete workable system ready for the Owner's operation. Any item not specifically shown on the Drawings or called for in the Specifications, but normally required to conform with the intent, are to be considered a part of the Contract.

H. These Specifications are basically equipment and performance Specifications. Actual installations shall be as shown on the Drawings. Installations and details shown on the Drawings shall govern where these differ from the Specifications.

I. All materials furnished by the Contractor shall be new and unused (temporary lighting and power products are excluded) and free from defects. All materials used shall bear the Underwriters Laboratory, Inc. label provided a standard has been established for the material in question.

J. All products and materials to be new, clean, free of defects and free of damage and corrosion.

K. No exclusion from, or limitation in, the symbolism used on the Drawings for electrical work or the languages used in the Specifications for electrical work shall be interpreted as a reason for omitting accessories necessary to complete any required system or item of equipment.

L. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

M. Except for conduit, conduit fittings, outlet boxes, wire and cable, all items of equipment or material shall be the product of one manufacturer throughout. Multiple manufacturers will not be permitted.

1.2 COORDINATION OF THE WORK

A. Certain materials will be provided by other trades. Examine the Contract Documents to ascertain these requirements.

B. Carefully check space requirements with other trades and the physical confines of the area to insure that all material can be installed in the spaces allotted thereto including finished suspended ceilings. Make modifications thereto as required and approved.

C. Transmit to other trades all information required for work to be provided under their respective sections in ample time for installation.

D. Wherever work interconnects with work of other trades, coordinate with other trades to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment. Identify all items of work that require access so that the ceiling trade will know where to install access doors and panels.

E. Due to the type of the installation, a fixed sequence of operation is required to properly install the complete systems. Coordinate, project and schedule work with other trades in accordance with the construction sequence.

F. The locations of lighting fixtures, outlets, panels and other equipment indicated on the Drawings are approximately correct, but they are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed in consequence of increase or reduction of the number of outlets, or in order to meet field conditions or to coordinate with modular requirements of ceilings, or to simplify the work, or for other legitimate causes.

G. Exercise particular caution with reference to the location of panels, outlets, switches, etc., and have precise and definite locations approved by the Engineer before proceeding with the installation.

H. The Drawings show only the general run of raceways and approximate location of outlets. Any significant changes in location of outlets, cabinets, etc., necessary in order to meet field conditions shall be brought to the immediate attention of the Engineer and shall receive approval before such alterations are made. All such modifications shall be made without additional cost to the Owner.

I. Obtain from the Engineer in the field the location of such outlets or equipment not definitely located on the Drawings.

J. Circuit "tags" in the form of arrows are used where shown to indicate the home runs of raceways to electrical distribution points. These tags show the circuits in each home run and the panel designation. Show the actual circuit numbers on the finished record tracing and on panel directory card. Where circuiting is not indicated, the Electrical Contractor must provide required circuiting in accordance with the loading indicated on the drawings and/or as directed.

K. The Drawings generally do not indicate the exact number wires in each conduit for the branch circuit wiring of fixtures, and outlets, or the actual circuiting. Provide the correct wire size and quantity as required by the indicated circuiting and/or circuit numbers indicated and control wiring diagrams, if any, specified voltage drop or maximum distance limitations, and the applicable requirements of the NEC.

L. Adjust location of conduits, panels, equipment, pull boxes, fixtures, etc. to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each raceway prior to installation.

1. Right of way: lines which pitch to have the right- of-way over those which do not pitch. For example: steam, condensate, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed to have right-of-way over lines whose elevations can be changed.
2. Make offsets, transitions and changes in direction in raceways and as required to maintain proper head room in pitch of sloping lines whether or not indicated on the Drawings.

M. Wherever the work is of sufficient complexity, prepare additional Detail Drawings to scale similar to that of the bidding Drawings, prepared on tracing medium of the same size as Contract Drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the Drawings as to the area to which it applies. Submit for review Drawings clearly showing the work and its relation to the work of other trades before commencing shop fabrication or erection in the field.

N. Contractor shall furnish services of an experienced Superintendent, who shall be in constant charge of all work, and who shall coordinate his work with the work of other trades. No work shall be installed before coordinating with other trades.

1.3 EXAMINATION OF SITE

A. Prior to submitting of bids, the Contractor shall visit the site of the job and shall familiarize himself with all conditions affecting the proposed installation and shall make provisions as to the cost thereof. Failure to comply with the intent of this paragraph will in no way relieve the Contractor of performing all necessary work shown on the Drawings.

1.4 PROGRESS OF WORK

A. The Contractor shall order the progress of his work so as to conform to the progress of the work of other trades and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from the defective or ill-timed work performed under this section shall be borne by the Contractor.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Ship and store all products and materials in a manner which will protect them from damage, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain replacement or repair. Any such repairs shall be subject to review and acceptance of the Engineer.

B. Delivery of Materials: Deliver materials (except bulk materials) in manufacturer's unopened container fully identified with manufacturer's name, trade name, type, class, grade, size and color.

C. Storage of Materials, Equipment and Fixtures: Store materials suitably sheltered from the elements, but readily accessible for inspection by the Engineer until installed. Store all items subject to moisture damage in dry, heated spaces.

1.6 EQUIPMENT ACCESSORIES

A. Establish sizes and location of the various concrete bases required. Coordinate with General Contractor and provide all necessary anchor bolts together with templates for holding these bolts in position.

B. Provide supports, hangers and auxiliary structural members required for support of the work.

C. Furnish and set all sleeves for passage of raceways through structural, masonry and concrete walls and floors and elsewhere as will be required for the proper protection of each raceway and passing through building surfaces.

D. Wall mounted equipment, total weight of 100 pounds or less, may be directly secured to wall by means of steel bolts. Maintain at least 1" air space between equipment and supporting wall. Groups or arrays of equipment, with total weight of more than 100 pounds, shall be mounted on adequately sized steel angles, channels, or bars. Prefabricated steel channels providing a high degree of mounting flexibility, such as those manufactured by Kindorf, Globe-Strutt and Unistrut, may be used for mounting arrays of equipment.

1.7 EXCAVATION AND TRENCHING

A. Provide excavation for the work. Excavate all material encountered, to the depths indicated on the Drawings or required. Remove from the site excavated materials not required or suitable for backfill. Provide grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Remove any water accumulating therein. Provide sheeting and shoring as may be necessary for the protection of the work and for the safety of personnel.

B. Provide trenches of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length. Except where rock is encountered, do not excavate below the depths indicated. Where rock excavations are required, excavate rock to a minimum overdepth of four inches below the trench depths indicated on the Drawings or required. Backfill overdepths in the rock excavation and unauthorized overdepths with loose, granular, moist earth, thoroughly machine tamped to a compaction level as specified by the Engineer. Whenever unstable soil incapable of properly supporting the work is encountered in the bottom of the trench as determined by the Engineer, remove soil to a depth required and backfill the trench to the proper grade with coarse sand, fine gravel or other suitable material.

C. Excavate trenches for utilities to a depth that will provide the following minimum depths of cover from existing grade or from indicated finished grade, whichever is lower, unless otherwise specifically shown.

1. Secondary electric service: 2 feet (minimum).
2. Telephone service: 2 feet (minimum).

1.8 BACKFILLING OF TRENCHES

A. Do not backfill trenches until all required tests have been performed and the installation observed by the Engineer. Comply with the requirements of other sections of these Specifications. Deposit backfill in 6 inch layers and thoroughly and carefully tamp until the work has a cover of not less than 1 foot. Backfill and tamp remainder of trench at 12 inch intervals until complete. Uniformly grade the finished surface. Install a 6” wide marking ribbon 12” above conduits.

1.9 CUTTING, PATCHING, ETC.

A. The work shall be carefully laid out in advance. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of raceway, outlets or other equipment, the work shall be carefully done. Any damage to the building, piping, equipment or defaced finish plaster, woodwork, metalwork, etc. shall be repaired by skilled mechanics of the trades involved at no additional cost to the Owner.

B. The Contractor shall do no cutting, channeling, chasing or drilling of unfinished masonry, tile, etc., unless he first obtains permission from the Engineer or Construction Manager. If permission is granted, the Contractor shall perform this work in a manner approved by the Construction Manager.

C. Where conduits, outlet, junction, or pull boxes are mounted on a painted surface, or a surface to be painted, they shall be painted to match the surface. Whenever support channels are cut, the bare metal shall be cold galvanized.

D. Slots, chases, openings and recesses through floors, walls, ceilings, and roofs will be provided by the various trades in their respective materials. The trade requiring them to properly locate such openings and be responsible for any cutting and patching caused by the neglect to do so.

1.10 NOMINAL VOLTAGES (UNLESS OTHERWISE NOTED)

A. Secondary distribution: 120/208 volt, 3-phase, 4-wire.

B. Secondary distribution: 277/480 volt, 3-phase, 4-wire

C. Secondary distribution: 120/240 volt, 1-phase, 3-wire

1.11 MOUNTING HEIGHTS

A. Unless otherwise noted or required because of special conditions, locate outlets as follows:

1. Heights listed are from finished floor to center of device. Verify exact locations with the Engineer before installation.

a.	Wall switch outlets	40"
b.	Bracket outlets	7'- 0" to bottom
c.	Convenience outlets (general)	18"
d.	Convenience outlets (mechanical areas)	4' - 0"
e.	Panelboard and distribution cabinet to top	6' - 6"
f.	Desk telephone outlets	18"
g.	Wall telephone outlets	4' - 9"
h.	Desk intercommunication outlets	1' - 6"
i.	Signal bells below ceiling	1' - 0"
j.	Clock outlets below ceiling	1' - 0"
k.	Chimes below ceiling	1' - 0"
l.	Television outlets	Adjacent to Data
m.	Pushbuttons	4' - 8"

1.12 CLEANING UP

A. Contractor shall take care to avoid accumulation of debris, boxes, crates, etc., resulting from the installation of work. Contractor shall remove from the premises each day all debris, boxes, etc., and keep the premises clean, subject to the Architect's instructions, which shall be promptly carried out.

B. Contractor shall clean all fixtures and equipment at the completion of the project.

C. All switchboards, panelboards, wireways, trench ducts, cabinets, enclosures, etc. shall be thoroughly vacuumed clean prior to energizing equipment and at the completion of the project. Equipment shall be opened for observation by the Architect as required.

1.13 WATERPROOFING

A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, perform it prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect and obtain written permission before penetrating and waterproof membrane, even where such penetration is shown on the Drawings. Perform work so as to maintain any warranties currently in effect.

B. If this Contractor penetrates any walls or surfaces after they have been waterproofed, this Contractor shall restore the waterproof integrity of that surface at the expense of this Contractor and as directed by the Architect.

1.14 SUPPORTS

A. Support work in accordance with the best industry practice and the following.

B. Include supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets.

C. Include supporting frames or racks for equipment, intended for vertical surface mounting, which is required in a free-standing position.

D. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members. They shall be rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.

E. Nothing, (including outlet, pull and junction boxes and fittings) shall depend on electric conduits, raceways, or cables for support, except that threaded hub type fittings having a gross volume not in excess of 100 cubic inches may be supported from heavy wall conduit, where the conduit in turn is securely supported from the structure within five inches of the fitting on two opposite sides.

F. Nothing shall rest on, or depend for support on, suspended ceilings media (tiles, lath, plaster, as well as splines, runners, bars and the like in the plane of the ceiling).

G. Provide required supports and hangers for conduit, equipment, etc., so that loading will not exceed allowable loadings of structure.

1.15 FASTENINGS

A. Fasten electric work to building structure in accordance with the best industry practice and the following.

B. As a minimum procedure, where weight applied to the attachment points is 100 pounds or less, fasten to building elements of:

1. Wood -- with wood screws.
2. Concrete and solid masonry -- with bolts and expansion shields.
3. Hollow construction -- with toggle bolts.
4. Solid metal -- with machine screws in tapped holes or with welded studs.
5. Steel decking or subfloor -- with fastenings as specified below for applied weights in excess of 100 pounds.

C. As a minimum procedure, where weight applied to building attachment points exceeds 100 pounds, but is 300 pounds or less, conform to the following:

1. At concrete slabs utilize 24" x 24" x 1/2" steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top of slab screen line, where no fill is to be applied.
2. At steel decking or subfloor for all fastenings, utilize through bolts or threaded rods. The tops of bolts or rods shall be set at least one inch below the top fill screen line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or subfloor manufacturer produces specialty hangers to work with his decking or subfloor such hangers shall be utilized.

D. Where weight applied to building attachments points exceeds 300 pounds, coordinate with and obtain approval of Architect and conform to the following:

1. Utilize suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Utilize threaded rods or bolts to attach to bridging members.

E. Floor mounted equipment shall not be held in place solely by its own dead weight. Include floor anchor fastenings in all cases.

F. For items which are shown as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.

1.16 FIRE STOPS

A. Openings for electrical equipment penetrating a fire rated floor, wall or ceilings, shall be resealed as required by Code. Install fire rated sealant equal to or greater than the fire rating of the penetrated surface.

1.17 PRODUCTS

A. If products and materials are specified or indicated on the Drawings or specifications for a specific item or system, use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of Shop Drawings where Shop Drawings are required or as approved in writing where Shop Drawings are not required.

1.18 OMISSIONS FROM THE DRAWINGS

A. Should a Bidder find discrepancies in or omissions from the drawings or specifications or be in doubt as to their meaning, he shall notify the Engineer before submitting his proposal. The Engineer will in turn, send written instructions to all Bidders. Neither the Engineer nor the Owner will be responsible for oral instructions. If the Contractor fails to comply with this requirement, he shall accept the Engineer’s interpretations as to the intended meaning of the drawings and specifications.

1.19 EXECUTION

A. Follow manufacturer's instructions for installing, connecting, and adjusting all equipment. Provide one copy of such instructions to the Architect before installing any equipment. Provide a copy of such instructions at the equipment during any work on the equipment. Provide all special supports, connections, wiring, accessories, etc.

B. Use mechanics skilled in their trade for all work.

C. Keep all items protected before and after installation. Clean up all debris.

D. Perform all tests required by local authorities in addition to tests specified herein, such as life safety systems.

E. Applicable equipment and materials to be listed by Underwriters' Laboratories and Manufactured in accordance with ASME, NEMA, ANSI or IEEE standards and as approved by local authorities having jurisdiction.

F. Before commencing work, examine all adjoining, underlying, etc., work on which this work is in any way dependent for perfect workmanship and report any condition which prevents performance of first class work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.

1.20 VERIFICATION OF ELECTRICAL REQUIREMENTS FOR EQUIPMENT FURNISHED BY OTHERS

A. Prior to the installation of wiring systems for any equipment furnished by others, this contractor shall verify that the electrical requirements of the equipment match those shown on the electrical drawings by examining the approved shop drawings of that equipment. Any discrepancies shall be immediately reported to the engineer.

B. If the contractor fails to comply with this requirement, he shall be responsible for any additional costs incurred at no additional cost to the Owner.

END OF SECTION 260210

SECTION 26 00 60 – ELECTRIC SERVICE ENTRANCE

PART 1.-GENERAL

1.1. SUMMARY:

A. Extent of service-entrance work is indicated by drawings and schedules.

B. Electrical service characteristics is new 225kVA, 480Y/277 volts, 3 phase, 4 wire, 60 Hz.

1. Electrical service to be underground.

C. Refer to other Division 26 sections for wires/cables, raceways, and electrical boxes and fittings work required in connection with service-entrance equipment.

1.2. QUALITY ASSURANCE:

A. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing service-entrance work similar to that required for this project.

B. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC, including Articles 230, 250, and 338, as applicable to installation, and construction of service-entrances.

2. NEMA Compliance: Comply with applicable construction and installation requirements of the following NEMA standards for service-entrance equipment and accessories:

3. Provide service-entrance equipment and accessories which are UL-listed and labeled, and marked, "SUITABLE FOR USE AS SERVICE EQUIPMENT."

1.3. SEQUENCE AND SCHEDULING:

A. Schedule delivery of service-entrance equipment which permits ready building ingress for large equipment components to their designated installation spaces. Coordinate delivery of equipment with the installation of other building components.

B. Coordinate the size and location of concrete equipment pads. Where equipment pads are to be cast-in-place by contractor. Cast anchor bolt inserts into pad. Concrete, reinforcement, and formwork requirements are specified in Division 3 and shall be provided in Electrical contractors scope of work.

C. Coordinate and schedule work with LOCI as required, including but not limited to: Start-ups, shut-downs, terminations etc.

D. Coordinate with other electrical work including raceways, electrical boxes and fittings, and cabling/wiring work, as necessary to interface installation of service-entrance work with other work.

PART 2.-PRODUCTS

2.1. NOT USED

PART 3.-EXECUTION

3.1. EXAMINATION:

A. Examine areas and conditions under which service-entrance equipment and components are to be installed, and notify Engineer in writing of condition detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to Engineer.

3.2. INSTALLATION OF SERVICE-ENTRANCE EQUIPMENT:

A. Install service-entrance equipment in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that service-entrance equipment fulfills requirements. Comply with applicable installation requirements of NEC and NEMA standards.

B. Install ground-fault protection devices complying with electrical winding polarities indicated.

C. Set field-adjustable GFP devices and circuit breakers for pickup and time-current sensitivity ranges required, subsequent to installation of devices and CB's.

D. Install fuses, of size indicated, in each switchgear.

E. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B, and the National Electrical Code.

F. Provide required protective bollards in accordance with LOCI requirements.

3.3. FIELD QUALITY CONTROL:

A. Prior to energization of service-entrance equipment, check accessible connections for compliance to manufacturer's torque tightening specifications.

B. Prior to energization of service-entrance equipment, check with ground resistance tester, phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

C. Prior to energization, check circuitry for electrical continuity, and for short- circuits.

3.4. GROUNDING:

A. Provide equipment grounding connections for service-entrance equipment as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounding.

B. Refer to drawings for design intent of service entrance ground system. System shall comply with NEC 250.

3.5. ADJUSTING AND CLEANING:

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred enclosure surfaces to match original finishes.

3.6. DEMONSTRATION:

A. Upon completion of installation of service-entrance equipment and electrical circuitry, energized circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest to demonstrate compliance.

END OF SECTION 26 00 60

SECTION 26 02 10 - EQUIPMENT CONNECTIONS AND COORDINATION

PART 1 - PART 1 - GENERAL

1.1 DESCRIPTION

A. General: Provide final connections to equipment and coordinate same in accordance with the Contract Documents. Reference shall be made to "Electrical General Provisions" for contractor's responsibility for verification of equipment furnished by others.

B. Equipment to receive final connections shall include but not be limited to the following:

1. Mechanical equipment
2. Appliances
3. Miscellaneous equipment
4. Owner furnished equipment

1.2 EXAMINATION OF DOCUMENTS

A. Prior to the submitting of bids, the Contractor shall familiarize himself with all conditions affecting the proposed installation of equipment requiring electrical connections and shall make provisions as to the cost thereof. Failure to comply with the intent of this paragraph shall in no way relieve the Contractor of performing all necessary work required for final electrical connections and equipment.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 MECHANICAL EQUIPMENT

A. All power wiring and connections for all motors including starters, controllers, and breakers as indicated on the drawings and the riser diagrams shall be furnished and installed under this section of the specifications.

B. Motors shall be connected in a neat and skillful manner. Ones delivered with terminal boxes that are inadequate shall be equipped with special boxes that suit the conditions.

C. In general, rigid conduit or tubing shall be used, but motors that require movement or ones that would transmit vibration to conduit shall be wired with liquid tight flexible steel conduit not over 18" long.

D. All motors shall be grounded with a green covered ground wire run inside the conduit and connected to motor frame on one end and to grounding system on the other end.

E. Motors, their starters and/or variable frequency drives (VFD's) not located in a motor control center are only approximately located on the drawings and the Contractor shall allow for the relocation that developed conditions may demand. Variable frequency drives (VFD's) are specified in Division 23 of the Specifications and should be reviewed for electrical contractor scope of work.

F. The location of motors, starters and control equipment and the arrangement to be followed shall be determined on the job jointly by the Contractor whose equipment is involved, this Contractor and the Architect.

G. Starting equipment shall be either wall mounted or free standing, as best suits conditions. If free standing, this Contractor shall make and install a suitable frame structural steel to accommodate it.

H. Furnish and install one motor snap switch of the proper size for disconnect of each single phase motor indicated on the drawings.

I. This Contractor shall be responsible for verifying the proper rotation for three phase motors.

J. The equipment supplier shall be responsible for verifying the proper rotation for single phase motors.

3.2 CONTROL WIRING

A. Control wiring for HVAC and Plumbing equipment will be furnished and installed by Plumbing and HVAC Contractor as specified in Division 23.

B. All control wiring in Division 23 is the responsibility of the Contractor who provides the particular equipment. Control wiring includes the providing of all required motor controls, relays, pilot devices, all related raceway systems, all related conductors and all final connections other than three phase power connections.

C. For single phase equipment provided under HVAC and Plumbing Contracts, this Contractor shall provide single phase feeders and make final connection.

D. All other control wiring required by other Divisions of the Specifications shall be furnished and installed by this Contractor. Unless specifically indicated on the drawings or specified hereinafter to the contrary, all control devices such as starters, pushbuttons, limit switches, etc., are furnished under other Divisions of the Specifications. This Contractor shall receive and store all electrical equipment to be installed by him. Conduit layout and arrangement of control wiring shall be done by this Contractor.

3.3 EQUIPMENT CONNECTIONS

A. This Contractor shall make final connections to all mechanical equipment.

END OF SECTION 260210

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Aluminum building wire rated 600 V or less.
3. Metal-clad cable, Type MC, rated 600 V or less.
4. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. PV: Photovoltaic.

B. RoHS: Restriction of Hazardous Substances.

C. VFC: Variable-frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers:
1. Southwire.
2. Encore Wire
3. Prysmian
4. Cerro Wire LLC.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.

3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 and ASTM B 787 for stranded conductors.

E. Conductor Insulation:

1. Type NM: Comply with UL 83 and UL 719.
2. Type RHH and Type RHW-2: Comply with UL 44.
3. Type USE-2 and Type SE: Comply with UL 854.
4. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
5. Type THHN and Type THWN-2: Comply with UL 83.
6. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
7. Type UF: Comply with UL 83 and UL 493.
8. Type XHHW-2: Comply with UL 44.

2.2 ALUMINUM BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers:
1. Southwire.
2. Encore Wire
3. Prysmian
4. Cerro Wire LLC.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Aluminum, complying with ASTM B 800, ASTM B 801, and ASTM B 836.

E. Conductor Insulation:

1. Type NM: Comply with UL 83 and UL 719.
2. Type RHH and Type RHW-2: Comply with UL 44.
3. Type USE-2 and Type SE: Comply with UL 854.
4. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
5. Type THHN and Type THWN-2: Comply with UL 83.
6. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
7. Type XHHW-2: Comply with UL 44.

2.3 METAL-CLAD CABLE, TYPE MC

A. THE USE OF MC CABLE IS NOT PERMITTED, EXCEPT FOR LIGHTING FIXTURE WHIPS ABOVE CEILING, 6FT IN LENGTH OR LESS.

B. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit with separate code sized ground conductor.

E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 and ASTM B 787 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation:

1. Type THHN/THWN-2: Comply with UL 83.

H. Armor: Steel interlocked.

2.4 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers:
1. 3M
2. AFC Cable Systems, Inc.
3. Hubbell Power Systems, Inc.
4. Ideal Industries, Inc.
5. O-Z/Gedney; an Emerson Industrial Automation business.
6. Square D Co.
7. ILSCO
8. Burndy
9. Thomas & Betts.
10. Bridgeport
11. Arlington

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: Two hole with standard barrels.
3. Termination: Crimp.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Aluminum conductors are not permitted for elevator or HVAC equipment and subject to compliance with additional drawing requirements.

C. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

D. Branch Circuits: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Aluminum conductors are not permitted for elevator or HVAC equipment and subject to compliance with additional drawing requirements.

E. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.

F. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders and branch circuits: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

E. Feeders and branch circuits installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, which will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Conductor Splices: Not permitted unless specifically noted on construction drawings.

C. Make terminations and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings when compared to the original conductors.

D. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.

E. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

F. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors.

3. Perform each of the following visual and electrical tests:

    1. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    2. Test bolted connections for high resistance using one of the following:

        1) A low-resistance ohmmeter.
        2) Calibrated torque wrench.
        3) Thermographic survey.

    3. Inspect compression-applied connectors for correct cable match and indentation.
    4. Inspect for correct identification.
    5. Inspect cable jacket and condition.
    6. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
    7. Continuity test on each conductor and cable.
    8. Uniform resistance of parallel conductors.

4. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

    1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

5. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

a. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, grounding connections for separately derived systems based on NETA MTS.

1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
2) Include recommended testing intervals.

1.6 QUALITY ASSURANCE

A. Qualifications: Member company of NETA or an NRTL.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Thomas & Betts.
4. Harger Lightning & Grounding.
5. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
6. Siemens Power Transmission & Distribution, Inc.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

C. Refer to Grounding Detail on drawings for more information.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Braided no. 30 AWG bare copper wire.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, ; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.

B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GENERATOR GORUNDING

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.6 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

H. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.

1. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.

3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07 72 00 "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. Flex-Strut Inc.
e. GS Metals Corp.
f. Thomas & Betts Corporation, A Member of the ABB Group.
g. Unistrut; an Atkore International company.
h. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. Fabco Plastics Wholesale Limited.

d. Seasafe, Inc.; AMICO, a Gibraltar Industries Company.

2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
3. Fitting and Accessory Materials: Same as channels and angles.
4. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Hilti, Inc.
2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti, Inc.
4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 05 50 00 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.

8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 05 50 00 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 “Painting Specifications” for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing, thin wall galvanized rigid steel conduit.

B. FMC: Flexible metal conduit.

C. LFMC: Liquid tight flexible metal conduit.

D. LFNC: Liquid tight flexible nonmetallic conduit.

E. RMC: Rigid metal conduit, heavy wall galvanized rigid steel conduit.

F. RNC: Rigid nonmetallic conduit.

G. ACI: American Concrete Institute.

1.3 SUBMITTALS

A. Product Data: For raceways, fittings, surface raceways and fittings, wireways, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: Include layout drawings showing components and wiring for nonstandard boxes, enclosures, and cabinets.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NECA's "Standard of Installation."

C. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metal Conduit and Tubing:

a. Allied Tube And Conduit
b. Alflex Corp.
c. Anamet, Inc.; Anaconda Metal Hose.
d. Anixter Brothers, Inc.
e. Carol Cable Co., Inc.
f. Electri-Flex Co.
g. Grinnell Co.; Allied Tube and Conduit Div.
h. Monogram Co.; AFC.
i. Republic Conduit.
j. Wheatland Tube Co.

2. Nonmetallic Conduit and Tubing:
a. Atkore Plastic Pipe Company (including products by Allied PVC or Heritage Plastics).
b. Anamet, Inc.; Anaconda Metal Hose.
c. Cantex Industries; Harsco Corp.
d. Condux International; Electrical Products.
e. Hubbell, Inc.; Raco, Inc.
f. Thomas & Betts Corp.;Carlon Electrical Products.
g. J. M. Eagle

3. Conduit Bodies and Fittings:

a. Crouse-Hinds; Div. of Cooper Industries.
b. Emerson Electric Co.; Appleton Electric Co.
c. Hubbell, Inc.; Killark Electric Manufacturing Co.
d. Thomas & Betts Corp.; Carlon Electrical Products.
e. O-Z/Gedney; Unit of General Signal.

4. Metal Wireways:

a. Hoffman Engineering Co.
b. Keystone/Rees, Inc.
c. Square D Co.

5. Nonmetallic Wireways:

a. Wiremold Co. (The); Electrical Sales Division.
b. Thomas & Betts; Carlon Electrical Products.

6. Surface Metal Raceways:

a. Wiremold Co. (The); Electrical Sales Division.
b. Superstrut. (T & B)
c. Hubbell, Inc.

7. Surface Nonmetallic Raceways:

a. Thomas & Betts; Carlon Electrical Products.
b. Panduit Corp.
c. Wiremold Co. (The); Electrical Sales Division.
d. Hubbell Inc.

8. Boxes, Enclosures, and Cabinets:

a. Crouse-Hinds; Div. of Cooper Industries.
b. Hoffman Engineering Co.; Federal-Hoffman, Inc.
c. Hubbell Inc.; Killark Electric Manufacturing Co.
d. Hubbell Inc.; Raco, Inc.
e. Thomas & Betts; Carlon Electrical Products.
f. O-Z/Gedney; Unit of General Signal.
g. Robroy Industries, Inc.; Electrical Division.
h. Scott Fetzer Co.; Adalet-PLM.

2.2 METAL CONDUIT AND TUBING

A. Rigid Metal Conduit: ANSI C80.1, heavy wall galvanized steel.

1. Use of aluminum or IMC conduit is not permitted.

B. EMT and Fittings: ANSI C80.3, thin wall galvanized steel.

1. Fittings: Set-screw type.

C. FMC: Zinc-coated steel.

D. LFMC: UL 360, Flexible steel conduit with PVC jacket.

E. Fittings: NEMA FB 1; compatible with conduit / tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Schedule 40 or 80 PVC.

B. RNC Fittings: NEMA TC 3, match to conduit or conduit / tubing type and material.

C. LFNC: UL 1660.

1. Use of ENT ("blue tube") is not permitted.

2.4 METAL WIREWAYS

A. Material: Sheet metal sized and shaped as indicated.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

D. Wireway Covers: Screw-cover type.

E. Finish: Manufacturer's standard enamel finish.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.

B. Surface Nonmetallic Raceways: 2-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.

C. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.6 OUTLET AND DEVICE BOXES

A. Sheet Metal Boxes: NEMA OS 1.

B. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.

C. Nonmetallic Boxes: NEMA OS 2.

2.7 FLOOR BOXES

A. Wood floors or concrete floors above slab on grade.

1. Floor Boxes: shall be sheet metal, fully adjustable, rectangular for single or dual services.
2. Fittings: shall be listed and labeled per UL514A.
3. Covers: shall be moptight style, black.

B. Concrete floors slab on grade.

1. Floor Boxes: Cast metal fully adjustable, rectangular for single or dual services gasket cover.
2. Fittings shall be listed and labeled.
3. Covers: "Mop Tight" style, black steel/aluminum.

2.8 PULL AND JUNCTION BOXES

A. Small Sheet Metal Boxes: NEMA OS 1.

B. Cast-Metal Boxes: NEMA FB 1, cast metal with gasketed cover.

2.9 ENCLOSURES AND CABINETS

A. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint

B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit: RMC
2. Concealed Conduit Aboveground: Rigid steel conduit: RMC.
3. Underground Conduit: RNC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or Type 4.

B. Indoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed and Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Physical Damage: Rigid steel conduit: RMC
3. Concealed in Ceilings and Walls and Partitions: EMT.
4. Buried in Earth or Concrete, Below Slab on Grade: RNC (SCHED 40)
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
6. Damp or Wet Locations: Rigid steel conduit: RMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

    a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets in compliance with NECA 1 according to manufacturer's written instructions, or per the construction documents, whichever is stricter.

1. Outlet boxes shall not be installed back-to-back for any system.

B. Minimum Raceway Size: 3/4-inch trade size (DN21) for power and lighting circuits. One (1)-inch trade size (DN27) for communications and data wiring.

C. Conceal conduit and EMT within ceilings, walls and partitions, unless otherwise indicated.

D. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communication conduits, for which fewer bends are allowed.

F. Install raceways level and square and at proper elevations. Provide adequate headroom.

G. Complete raceway installation before starting conductor installation.

H. Support raceways as specified in Division 26 Section "Basic Electrical Materials and Methods."

I. Use temporary closures to prevent foreign matter from entering raceways.

J. Protect stub-ups from damage where conduits rise through floor slabs. Provide 4 inches of concrete around stub ups. Arrange so curved portion of bends is not visible above the finished slab.

K. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

L. Use raceway fittings compatible with raceways and suitable for use and location. For conduits crossing building expansion joints, provide expansion fittings with ground continuity.

M. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.

N. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

1. Run parallel or banked raceways together, on common supports where practical.
2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

O. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
2. Use insulating bushings to protect conductors.

P. Tighten set screws of threadless fittings with suitable tools.

Q. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.

R. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

S. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

T. Telephone and Signal System Raceways, 2-Inch Trade Size (DN53) and Smaller: In addition to the above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

U. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces or exterior walls.
2. Where otherwise required by NFPA 70.

V. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.

W. Flexible Connections: Use maximum of 6 feet (1830 mm) of minimum ½" flexible metal conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

X. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals.

1. Select each surface raceway outlet box, to which a lighting fixture is attached, of sufficient diameter to provide a seat for the fixture canopy.
2. Where a surface raceway is used to supply a fluorescent lighting fixture having central-stem suspension with a backplate and a canopy (with or without extension ring), no separate outlet box is required.
3. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end-stem suspension.

Y. Set floor boxes level and trim after installation to fit flush to finished floor surface.

Z. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

AA. Provide outlet boxes and raceway for other trades' low voltage devices such as power door push plates.

BB. Provide Code sized pull and junction boxes as necessary or as required by NEC. All straight conduit runs shall not exceed 100' without a pull box, and a run of conduit shall not contain more than the equivalent of 4 quarter bends between boxes. All junction boxes shall have closed covers and shall be accessible after completion of the installation.

CC. All conduit in exterior cavity walls shall be run within the back-up wythe of the wall. Except for where conduit extend through the wall cavity, perpendicular to the wall plane, to exterior mounted fixtures, the wall cavity shall be kept clear of all such conduit.

DD. All underground raceways (used or spare) enter buildings or structures shall be sealed or plugged per NEC 225.27 (2011).

EE. Embedded raceways in elevated slabs or slabs on form deck are not permitted.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to the manufacturer and installer, to ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Project Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 26 05 33

SECTION 26 05 43 – UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Ducts in direct-buried duct banks.
2. Ducts in concrete-encased duct banks.
3. Handholes and handhole accessories.
4. Manholes and manhole accessories.

B. Related Sections include but are not limited to the following:

1. Division 03 "Cast in Place Concrete"
2. Division 26 Section "Grounding and Bonding" for grounding electrodes, counterpoise conductors, clamps and connectors for grounding metallic manhole and handhole accessories, and testing of grounds.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Manhole and handhole hardware.
2. Conduit and ducts, including elbows, bell ends, bends, fittings, and solvent cement.
3. Duct-bank materials, including spacers and miscellaneous components.
4. Warning tape.

B. Shop Drawings: Show fabrication and installation details for underground ducts and utility structures and include the following:

1. For manholes:

a. Duct sizes and locations of duct entries.
b. Reinforcement details.
c. Manhole cover design.
d. Step details.
e. Grounding details.
f. Dimensioned locations of cable rack inserts, pulling-in irons, and sumps.

2. For precast manholes and handholes, Shop Drawings shall be signed and sealed by a qualified Professional Engineer, and shall show the following:

a. Construction of individual segments.
b. Joint details.
c. Design calculations.

C. Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures. Include plans and sections drawn to scale, and show all bends and location of expansion fittings.

D. Product Certificates: For concrete and steel used in underground precast manholes, according to ASTM C 858.

E. Product Test Reports: Indicate compliance of manholes with ASTM C 857 and ASTM C 858, based on factory inspection.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories (Including Ducts for Communications and Telephone Service): Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete units at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.5 COORDINATION

A. Coordinate layout and installation of ducts, manholes, and handholes with final arrangement of other utilities and site grading, as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into manholes and handholes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations from those indicated as required to suit field conditions and to ensure duct runs drain to manholes and handholes, and as approved by A/E.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Underground Precast Concrete Utility Structures:

a. Mack Industries, Inc.
b. Lindsey Concrete Products Co., Inc.
c. United Precast.

2. Frames and Covers:

a. Campbell Foundry Co.

b. East Jordan Iron Works, Inc.
c. McKinley Iron Works, Inc.
d. Neenah Foundry Co.

3. Nonmetallic Ducts and Accessories:

a. Arnco Corp.
b. Beck Manufacturing Inc.
c. Cantex, Inc.
d. Certainteed Corp.; Pipe & Plastics Group.
e. ElecSys, Inc.
f. Electri-Flex Co.
g. Lamson & Sessions; Carlon Electrical Products.
h. Manhattan/CDT/Cole-Flex.
i. Spiraduct/AFC Cable Systems, Inc.

2.2 CONDUIT

A. Conduit and fittings are specified in Division 26 Section "Raceways and Boxes."

2.3 DUCTS

A. Rigid Nonmetallic Conduit: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by the same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.4 HANDHOLES

A. Cast-Metal Boxes: Cast aluminum, with outside flanges and recessed, gasketed cover for flush mounting and with nonskid finish and legend on cover. Unit, when buried, shall be designed to support AASHTO H10 loading.

B. Precast Handholes: Reinforced concrete, monolithically poured walls and bottom, with frame and access door assembly as the top of handhole. Duct entrances and windows shall be located near corners to facilitate racking. Pulling-in irons and other built-in items shall be installed before pouring concrete. Cover shall have nonskid finish and legend. Unit, when buried, shall be designed to support AASHTO H10 loading.

C. Fiberglass Handholes: Molded fiberglass, with 6-inch square cable entrance at each side and weatherproof cover with nonskid finish and legend. Unit, when buried, shall be designed to support AASHTO H10 loading.

D. Cover Legend: "ELECTRIC."

2.5 PRECAST MANHOLES

A. Precast Units: ASTM 478, with interlocking mating sections, complete with accessories, hardware, and features as indicated. Include concrete knockout panels for conduit entrance and sleeve for ground rod.

B. Design and fabricate structure according to ASTM C 858.

C. Design structure according to details on Drawings.

D. Structural Design Loading: ASTM C 857, Class A-16.

E. Joint Sealant: Continuous extrusion of asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

F. Source Quality Control: Inspect structures according to ASTM C 1037.

2.6 CAST-IN-PLACE MANHOLES

A. Loading: AASHTO.

2.7 ACCESSORIES

A. Duct Spacers: Rigid PVC interlocking spacers, selected to provide minimum duct spacings and cover depths indicated while supporting ducts during concreting and backfilling; produced by the same manufacturer as the ducts.

B. Manhole Frames and Covers: Comply with AASHTO loading specified for manhole.

1. Provide cast covers with cast-in legend:

a. "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600V and less.
b. "ELECTRIC-HV" for duct systems with medium-voltage cables.
c. "SIGNAL" for communications, data, and telephone duct systems.

2. Cast iron with cast-in legend "ELECTRIC" as indicated. Milled cover-to-frame bearing surfaces.
3. Manhole Frames and Covers: ASTM A 48; Class 30B gray iron, 30-inch size, machine-finished with flat bearing surfaces.
4. Special Covers: Recess on cover designed to accept finish material in paved areas.

C. Sump Frame and Grate: ASTM A 48, Class 30B gray cast iron.

D. Pulling Eyes in Walls: Eyebolt with reinforcing-bar fastening insert 2-inch diameter eye and 1-by-4 inch.

1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

E. Pulling and Lifting Irons in Floor: 7/8-inch diameter, hot-dip-galvanized, bent steel rod; stress relieved after forming; and fastened to reinforced rod. Exposed triangular opening.

1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

F. Bolting Inserts for Cable Stanchions: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

G. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

H. Cable Stanchions: Hot-rolled, hot-dip-galvanized, T-section steel; 2-1/4-inch size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.

I. Cable Arms: 3/16-inch thick, hot-rolled, hot-dip-galvanized, steel sheet pressed to channel shape; 12 inches wide by 14 inches long and arranged for secure mounting in horizontal position at any location on cable stanchions.

J. Cable-Support Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

K. Grounding Materials: Comply with Division 26 Section "Grounding and Bonding."

L. Ladder: UL-listed, heavy-duty wood specifically designed for electrical manhole use. Minimum length equal to distance from deepest manhole floor to grade plus 36 inches.

M. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and of adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

N. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification of Electrical Systems."

2.8 CONSTRUCTION MATERIALS

A. Waterproofing: Comply with Division 07 Section "Fluid-Applied Waterproofing."

B. Mortar: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C 387, Type M, may be used.

C. Brick for Manhole Chimney: Sewer and manhole brick, ASTM C 32, Grade MS.

D. Concrete: Use 3000-psi minimum, 28-day compressive strength and 3/8-inch maximum aggregate size. Concrete and reinforcement are specified in Division 03 Section "Cast-in-Place Concrete."

PART 3 - EXECUTION

3.1 APPLICATION

A. Underground Ducts for Electrical Cables Higher Than 600 V: Type EPC-80-PVC, direct buried duct bank under driveway, roadway; parking lot: Type EPC-40-PVC, concrete encased duct bank.

B. Underground Ducts for Electrical Feeders: Type EPC-80-PVC, direct buried duct bank.

C. Underground Ducts for Electrical Branch Circuits: Type EPC-40-PVC, direct-buried duct bank.

D. Underground Ducts for Telephone Utility Service: Type EPC-80-PVC, direct-buried duct bank, except use Type EPC-80-PVC when crossing roads and railroads.

E. Underground Ducts for Communication Circuits: Type EPC-80-PVC, direct-buried duct bank.

F. Manholes: Underground precast concrete utility structures.

G. Manholes: Cast-in-place concrete.

3.2 EARTHWORK

A. Excavation and Backfill: Comply with Division 31 Section "Earthwork" but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32 Section "Turf and Grasses/Plants."

D. Restore disturbed pavement. Refer to Division 32 Section "Asphalt/Concrete Paving."

3.3 CONDUIT AND DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.

B. Curves and Bends: Use manufactured elbows for stub-ups at equipment and at building entrances. Use manufactured long sweep bends with a minimum radius of 25 feet, both horizontally and vertically, at other locations.

C. Use solvent-cement joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.

D. Duct Entrances to Manholes and Handholes: Space end bells approximately 10 inches o.c. for 5-inch ducts and vary proportionately for other duct sizes. Change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line. Grout end bells into manhole walls from both sides to provide watertight entrances.

E. Building Entrances: Make a transition from underground duct to conduit at least 10 feet outside the building wall. Use fittings manufactured for this purpose. Follow the appropriate installation instructions below:

1. Concrete-Encased Ducts: Install reinforcement in duct banks passing through disturbed earth near buildings and other excavations. Coordinate duct bank with structural design to support duct bank at wall without reducing structural or watertight integrity of building wall.
2. Direct-Buried, Nonencased Ducts at Nonwaterproofed Wall Penetrations: Install a Schedule 40, galvanized steel pipe sleeve for each duct. Calk space between conduit and sleeve with duct-sealing compound on both sides for moisture-tight seal.
3. Waterproofed Wall and Floor Penetrations: Install a watertight entrance-sealing device with sealing gland assembly on the inside. Anchor device into masonry construction with one or more integral flanges. Secure membrane waterproofing to the device to make permanently watertight.

F. Concrete-Encased, Nonmetallic Ducts: Support ducts on duct spacers, spaced as recommended by manufacturer and coordinated with duct size, duct spacing, and outdoor temperature. Install as follows:

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts and secure separators to earth and to ducts to prevent floating during concreting. Stagger spacers approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
2. Concreting: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto

ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application. Pour each run of envelope between manholes or other terminations in one continuous operation. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.

3. Reinforcement: Reinforce duct banks where they cross disturbed earth and where indicated.
4. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
5. Minimum Clearances between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
6. Depth: Install top of duct bank at least 24 inches below finished grade in nontraffic areas and at least 30 inches below finished grade in vehicular traffic areas, unless otherwise indicated.

G. Direct-Buried Ducts: Support ducts on duct spacers, spaced as recommended by manufacturer and coordinated with duct size, duct spacing, and outdoor temperature. Install as follows:

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts.
2. Install expansion fittings as shown on Shop Drawings.
3. Trench Bottom: Continuous, firm, and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earthwork" for pipes less than 6 inches in nominal diameter.
4. Backfill: Install backfill as specified in Division 31 Section "Earthwork." After installing first tier of ducts, backfill and compact. Repeat backfilling after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, complete backfilling normally.
5. Minimum Clearances between Ducts: 3 inches between ducts for like services and 6 inches between power and signal ducts.
6. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.

H. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank.

I. Stub-ups: Use rigid steel conduit for stub-ups to equipment. For equipment mounted on outdoor concrete bases, extend steel conduit a minimum of 5 feet from edge of base. Install insulated grounding bushings on terminations. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches of concrete.

J. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

K. Pulling Cord: Install 100-lbf test nylon cord in ducts, including spares.

3.4 MANHOLE AND HANDHOLE INSTALLATION

A. Elevation: Install manholes with rooftop at least 15 inches below finished grade. Install handholes with depth as indicated. Where indicated, cast handhole cover frame directly into roof of handhole and set roof surface 1 inch above grade.

B. Drainage: Install drains in bottom of units where indicated. Coordinate with drainage provisions indicated.

C. Access: Install cast-iron frame and cover.

1. Install brick chimney to support frame and cover and to connect cover with roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.
2. Install precast collars and rings to support frame and cover and to connect cover with roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.
3. Set frames in paved areas and trafficways flush with finished grade. Set other frames 1 inch above finished grade.

D. Waterproofing: Apply waterproofing to exterior surfaces of units after concrete has cured at least three days. Apply according to Division 07 Section "Fluid-Applied Waterproofing." After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole and handhole chimneys after brick mortar has cured at least three days.

E. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

F. Field-Installed Bolting Anchors: Do not drill deeper than 3-7/8 inches for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

G. Grounding: Install ground rod through floor in each structure with top protruding 4 inches above floor. Seal floor opening against water penetration with waterproof nonshrink grout. Ground exposed metal components and hardware with bare-copper ground conductors. Train conductors neatly around corners. Use cable clamps secured with expansion anchors to attach ground conductors.

H. Cast-in-Place Manhole Installation: Comply with applicable requirements in Division 03 Section "Cast-in-Place Concrete."

1. Finish interior surfaces with a smooth-troweled finish.
2. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches thick, arranged as indicated.

I. Precast Concrete Manhole Installation: Unless otherwise indicated, comply with ASTM C 891.

1. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
2. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

3.5 FIELD QUALITY CONTROL

A. Testing: Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

B. Grounding: Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding."

C. Duct Integrity: Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of the duct. If obstructions are indicated, remove obstructions and retest.

D. Correct installations if possible and retest to demonstrate compliance. Remove and replace defective products and retest.

3.6 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 26 05 43

SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 07 84 13 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

    a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
    b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Advance Products & Systems, Inc.
    b. CALPICO, Inc.
    c. Metraflex Company (The).
    d. Pipeline Seal and Insulator, Inc.
    e. Proco Products, Inc.
    f. Specified Technologies, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Resealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall have VOC content calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 92 00 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 05 44

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

1.2 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Submit sample of "Arc Flash Hazard" warning sign.

1.3 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 RACEWAY AND CABLE LABELS

A. Manufacturers: Provide products by one of the following:

1. Ideal Industries.
2. 3M.
3. Thomas & Betts.

B. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

1. Color: Black letters on orange field.
2. Legend: Indicates voltage and service.

C. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend over-laminated with a clear, weather-and chemical-resistant coating.

D. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suite the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.

E. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3mils thick by 1 to 2 inches wide (0.08 mm thick by 25 to 51 mm wide).

F. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.

1. Not less than 6 inches wide by 4 mils thick (152 mm wide by 0.102 mm thick).
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend indicating type of underground line.

G. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

H. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch (0.4 mm-) thick aluminum sheet, with stamped or embossed legend, and fitter with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.

I. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.

J. Aluminum-Faced, Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch (0.05 mm) thick, laminated with moisture-resistant acrylic adhesive, punched for fasteners, and preprinted with legends to suit each application.

K. Brass or Aluminum Tags: 2 by 2 by 0.05-inch (51 by 1.3-mm) metal tags with stamped legend, punched for fastener.

2.2 NAMEPLATES AND SIGNS

A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.

B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.

a. For emergency systems: white letters with red face.

2. Punched or drilled for mechanical fasteners.

C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. 1/4-inch (6.4-mm) grommets in corners for mounting.

D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for the application. 1/4-inch (6.4-mm) grommets in corners for mounting.

E. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength: 50 lb (22.3 kg) minimum.
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Colors: to suit coding scheme.

B. Paint: Formulated for the type of surface and intended use.

1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.

C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before applying.

E. Circuits with More Than 600 V: Identify raceway and cable with "DANGER--HIGH VOLTAGE" in black letters 2 inches (51 mm) high, stenciled with paint at 10-foot (3-m) intervals over a continuous, painted orange background. Identify the following:

1. Entire floor area directly above conduits running beneath and within 12 inches (305 mm) of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to conduits concealed within wall.
3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in the building, or concealed above suspended ceilings.
4. Entire surface of exposed conduits.

F. Install painted identification according to manufacturer's written instructions and as follows:

1. Clean surfaces of dust, loose material, and oily films before painting.
2. Prime surfaces using type of primer specified for surface.
3. Apply one intermediate and one finish coat of enamel.

G. Color Banding Raceways and Exposed Cables: Band exposed and accessible raceways of the systems listed below:

1. Bands: Pretensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
3. Apply the following colors to the systems listed below:

a. Fire Alarm System: Red.
b. Fire-Suppression Supervisory and Control System: Red and yellow.
c. Combined Fire Alarm and Security System: Red and blue.
d. Security System: Blue and yellow.
e. Mechanical and Electrical Supervisory System: Green and blue.

f. Telecommunication System: Green and yellow.

H. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.

I. Circuit Identification Labels on Boxes: Install labels externally.

1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
2. Concealed Boxes: Plasticized card-stock tags.
3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

J. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm) overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.

K. Secondary Service, Feeder, and Branch-Circuit Conductors: Color-code throughout the secondary electrical system.

1. Provide a means of identifying Branch Circuit Phase Conductors, Grounded Conductors, and Ungrounded Conductors. The means of identification shall be documented in a manner that is readily available or shall be permanently posted where the conductors of different systems originate.

2. Color-code 208/120-V system as follows:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.
d. Neutral: Continuous White outer finish, or three continuous White stripes along entire length of grounded conductor with a readily distinguishable colored insulation (other than green).
e. Ground: Green.
f. Isolated Ground: Green with White stripe.

3. Color-code 480/277-V system as follows:

a. Phase A: Brown
b. Phase B: Orange.
c. Phase C: Yellow.
d. Neutral: Continuous Grey outer finish, or three continuous Grey stripes along entire length of grounded conductor with a readily distinguishable colored insulation (other than green).
e. Ground: Green with one or more yellow stripes.

4. Factory applied color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-colored wire for sizes larger than, but not including, No. 10 AWG:

a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch- (25-mm-) wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches (76 mm) from the terminal and spaced 3 inches (76 mm) apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.

L. Apply identification to conductors as follows:

1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.

M. Apply warning, caution, and instruction signs as follows:

1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

N. Flash Protection Field Marking: Per NFPA 70E, ANSI Z535.4, ISO 3864, NEC 110.16, Electrical equipment such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized, shall be field marked with a label containing all of the following information:
1. Nominal system voltage and the arc flash boundary, as well as the following: available incident energy and the corresponding working distance, minimum arc rating of clothing, required level of PPE, and highest Hazard/Risk Category (HRC) for the equipment.
2. Provide waterproof equipment labels, sized as required. Refer to detail on drawings for example of arc flash warning labels.
3. The sign shall be prominently mounted on the front of the equipment and readily visible. If the equipment has multiple removable front covers, a sign shall be mounted on each cover. For flush mounted panelboards in finished spaces, the sign shall be mounted on the inside of the door or front cover.

O. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Refer to drawings for nameplate detail for more information. Apply labels for each unit of the following categories of equipment using mechanical fasteners:

1. Panelboards, electrical cabinets, and enclosures.
2. Access doors and panels for concealed electrical items.
3. Electrical switchgear and switchboards.
4. Emergency system boxes and enclosures.
5. Motor-control centers.
6. Disconnect switches.
7. Enclosed circuit breakers.
8. Motor starters and VFD's.
9. Power transfer equipment.
10. Contactors.
11. Dimmers.
12. Control devices.
13. Transformers.
14. Power-generating units.
15. Telephone switching equipment.
16. Fire alarm master station or control panel.
17. Security-monitoring master station or control panel.

END OF SECTION 26 05 53

SECTION 26 05 70 - OVERCURRENT PROTECTIVE DEVICE COORDINATION AND ARC FLASH STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes computer-based, fault-current and overcurrent protective device coordination studies, and the setting of these devices.

1. Coordination of series-rated devices is permitted where indicated on Drawings.

1.2 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399. For arch-flash study, computer software programs, certifying compliance with IEEE 1584.

C. Qualification Data: For coordination-study specialist and arc-flash study specialist.

D. Other Action Submittals:

1. Coordination-study input data, including completed computer program input data sheets and letter from utility company indicating estimated available fault current as utility transformer location.
2. Coordination-study report.
3. Equipment evaluation report.
4. Setting report.
5. Fault current study.
6. Arc-Flash Protection Study, report and labeling.

1.3 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An organization experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

C. Comply with IEEE 399 for general study procedures.

D. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

E. Comply with IEEE 1584 for arc-flash study procedure and labeling, and NFPA-70E for personnel protective equipment recommendations and labeling.

F. Comply with ANSI Z535 safety standards.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Available Computer Software Developers: Subject to compliance with requirements, companies offering computer software programs that may be used in the Work include, but are not limited to, the following:

1. CYME International, Inc.
2. EDSA Micro Corporation.
3. Electrical Systems Analysis, Inc. (ESA)
4. SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399, Table 7-4.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices.

1. Optional Features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

D. Comply with IEEE 1584.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

B. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices not submitted for approval with coordination study may not be used in study.

3.2 FAULT-CURRENT STUDY

A. Source Impedance: As an infinite bus on primary side of transformer.

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project and use approved computer software program to calculate values. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with the following:

1. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.50.
2. Low-Voltage Fuses: IEEE C37.46.
3. Circuit Breakers: IEEE C37.13.

E. Study Report: Enter calculated X/R ratios and interrupting (5-cycle) fault currents on electrical distribution system diagram of the report. List other output values from computer analysis, including momentary (1/2-cycle), interrupting (5-cycle), and 30-cycle fault-current values for 3-phase, 2-phase, and phase-to-ground faults.

F. Equipment Evaluation Report: Prepare a report on the adequacy of overcurrent protective devices and conductors by comparing fault-current ratings of these devices with calculated fault-current momentary and interrupting duties.

3.3 COORDINATION STUDY

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Impedance of utility service entrance.
3. Electrical distribution system diagram showing the following:

    a. Load current that is the basis for sizing continuous ratings of circuits for cables and equipment.
    b. Circuit-breaker and fuse-current ratings and types.
    c. Relays and associated power and current transformer ratings and ratios.
    d. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
    e. Generator kilovolt amperes, size, voltage, and source impedance.
    f. Cables. Indicate conduit material, sizes of conductors, conductor insulation, and length.
    g. Motor horsepower and code letter designation according to NEMA MG 1.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Magnetic inrush current overload capabilities of transformers.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Ratings, types, and settings of overcurrent protective devices.
    e. Special overcurrent protective device settings or types stipulated by Owner or A/E.
    f. Time-current-characteristic curves of devices indicated to be coordinated.
    g. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    h. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    i. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

B. Perform coordination study and prepare a written report using the results of fault-current study and approved computer software program. Comply with IEEE 399.

C. Comply with NFPA 70 for overcurrent protection of circuit elements and devices.

D. Comply with IEEE 141 and IEEE 242 recommendations for fault currents and time intervals.

E. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
b. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device shall protect transformer according to IEEE C57.12.00, for fault currents.

F. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Verify adequacy of phase conductors at maximum three-phase bolted fault currents, equipment grounding conductors, and grounding electrode conductors at maximum ground-fault currents.

G. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings for Overcurrent Protective Devices:

a. Device tag.
b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
d. Fuse-current rating and type.
e. Ground-fault relay-pickup and time-delay settings.

2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between series devices, including upstream devices. Show the following specific information:

a. Device tag.
b. Voltage and current ratio for curves.
c. Three-phase and single-phase damage points for each transformer.
d. No damage, melting, and clearing curves for fuses.
e. Cable damage curves.
f. Transformer inrush points.
g. Maximum fault-current cutoff point.

3. Completed data sheets for setting of overcurrent protective devices.
4. Provide all project files on disk.

3.4 OVERCURRENT PROTECTIVE DEVICE SETTING

A. Testing: Perform the following device setting and prepare reports:

1. After installing overcurrent protective devices and during energizing process of electrical distribution system, perform the following:

a. Verify that overcurrent protective devices meet parameters used in studies.

b. Adjust devices to values listed in study results.

2. Adjust devices according to recommendations in Chapter 7, "Inspection and Test Procedures," and Tables 10.7 and 10.8 in NETA ATS.

3.5 IDENTIFICATION OF AVAILABLE FAULT CURRENT

A. Service equipment shall be legibly marked in the field with the maximum available fault current. The field marking(s) shall include the date the fault current calculation was performed and be of sufficient durability to withstand the environment involved in accordance with NEC 110.24, 2014.

3.6 ARC-FLASH STUDY

A. Perform an arc-flash study using approved computer software program. Prepare a written report using results of arc-flash study. Study shall comply with NFPA 70E-2015 Section 130.5 "Arc Flash Risk Assessment", OSHA 1910.269 and NEC 110-16, 2014.

1. Perform a risk assessment to determine the appropriate safety-related work practices, the arc flash boundary, and the PPE to be used within the arc flash boundary. The risk assessment shall be performed per NFPA-70E Section 130.5.

2. Provide equipment labels that comply with NFPA-70E 2018 Section 130.5(D). Based on the results, produce and install a warning label (orange < 40 cal/cm^2) or danger label (red > 40 cal/cm^2) for each piece of equipment in accordance with ANSI Z535.4-2011. The label must be readable in both indoor and outdoor environments for at least 3 years.

3. Provide a comprehensive report that includes:
   - Report summary with analysis methodology, findings and recommendations
   - Summary of input data for utility source, equipment and cables
   - Available fault current at each equipment location with comparison to equipment rating
   - Incident energy level (calories/cm^2) for each equipment location and recommended PPE
   - Complete system single-line diagram for the system analyzed

END OF SECTION 26 05 70

SECTION 26 09 24 - LIGHTING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 27 26 – Wiring Devices:
   1. Finish requirements for wall controls specified in this section.
   2. Accessory receptacles and wallplates, to match lighting controls specified in this section.

1.2 SUMMARY

A. Whole building wireless lighting control systems and associated components:

   1. Wireless occupancy/vacancy sensors.
   2. Wired load control modules with wireless communication inputs.
   3. Wireless fixture control components factory-installed in luminaires not specified in this section.
   4. Wireless control stations.
   5. Power interfaces.
   6. Digital dimming ballast modules.

B. Wireless hub(s) for centralized control, monitoring, and system integration.

C. Software data and analytics dashboard, including server requirements.

1.3 COORDINATION

A. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.

B. Coordinate the placement of wall controls with actual installed door swings.

C. Coordinate the placement of daylight sensors with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.

D. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.

E. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

F. Pre Installation Meeting; Include as part of the base bid costs for Lighting Control Manufacturer to conduct on-site meeting prior to commencing work. Manufacturer to review with installer:

   1. Low voltage wiring requirements.
   2. Separation of power and low voltage/data wiring.
   3. Wire labeling.
   4. Wireless hub locations and installation.
   5. Lighting Control Manufacturer Sensor Layout review. Sensor locations to be reviewed in accordance with layout provided by Lighting Control Manufacturer. Lighting Control

Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.

6. Control locations.
7. Computer jack locations.
8. Load circuit wiring.
9. Network wiring requirements.
10. Connections to other equipment.
11. Installer responsibilities.

G. Sequencing:

1. Do not install sensors and wall controls until final surface finishes and painting are complete.

1.4 ACTION SUBMITTALS

A. Design Documents: Lighting Control Manufacturer to provide plans indicating occupancy/vacancy and/or daylight sensor locations.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.
2. Wall Dimmers: Include derating information for ganged multiple devices.

C. Samples:

1. Wall Controls:
   a. Show available color and finish selections.

D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual installed locations and settings for lighting control system components.

F. Operation and Maintenance Data: Include detailed information on lighting control system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

G. Warranty: Submit sample of manufacturer's Warranty or Enhanced Warranty as specified in Part 1 under “WARRANTY”. Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.
B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Manufacturer Qualifications:
   1. Company with not less than ten years of experience manufacturing lighting control products using wireless communication between devices.
   2. Registered to ISO 9001, including in-house engineering for product design activities.
   3. Provides factory direct technical support hotline available 24 hours per day, 7 days per week.
   4. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.7 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.
   1. Basis of Design System Requirements - Unless Otherwise Indicated:
      a. Ambient Temperature:
         1) Lighting Control System Components: Between 32 and 104 degrees F (0 and 40 degrees C).
      b. Relative Humidity: Less than 90 percent, non-condensing.
      c. Protect lighting controls from dust.

1.8 WARRANTY

A. Manufacturer's Standard Warranty, 2 year from date of substantial completion.
   1. Manufacturer Lighting Control System Components, Except Lighting Management System Computer, Ballasts/Drivers and Ballast Modules:
      a. First Two Years:
         1) 100 percent replacement parts coverage, 100 percent manufacturer labor coverage to troubleshoot and diagnose a lighting issue.
         2) First-available on-site or remote response time.
         3) Remote diagnostics for applicable systems.
      b. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.
   2. Lighting Management System Computer,smart device or lighting control head-end: One year 100 percent parts coverage, one year 100 percent manufacturer labor coverage.
   3. Ballasts/Drivers and Ballast Modules:
      a. With Remote Full-Scope Start-Up: Three years 100 percent parts coverage, no manufacturer labor coverage.
      b. With On-Site Full-Scope Start-Up: Five years 100 percent parts coverage, no manufacturer labor coverage.

PART 2 PRODUCTS

2.1 SYSTEM MANUFACTURER

A. Basis of Design System:
   1. Lutron Electronics Company, Inc; Vive.
   2. NLight Air
   3. NX Lighting Control System

B. References to manufacturer's model numbers and other information are intended to establish minimum standards of performance, function, and quality.

C. Substitutions:

   1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by Architect prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
   2. By using substitutions to Basis of Design Manufacturer, Contractor accepts responsibility and associated costs for all required modifications to related equipment and wiring. Provide complete engineered shop drawings (including power wiring) with deviations from the original design highlighted in an alternate color for review and approval by Architect prior to rough-in.

D. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.2 LIGHTING CONTROLS - GENERAL REQUIREMENTS

A. Sensor Layout and Tuning:
   1. During startup, Lighting Control Manufacturer to direct Contractor regarding sensor relocation, as required, should conditions require a deviation from locations specified in the drawings.

B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.

C. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, programming, etc. as necessary for a complete operating system that provides the control intent indicated.

D. Design lighting control equipment for 10 year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C) and 90 percent non-condensing relative humidity.

E. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.

F. Power Failure Recovery: When power is and subsequently restored, lights to automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.

G. Wireless Devices:

   1. Wireless device family includes area or fixture level sensors, area or fixture level load controls for dimming or switching, and load controls that can be mounted in a wallbox, on a junction box, or at the fixture.
   2. Wireless devices including sensors, load controls, and wireless remotes or wall stations, can be set up using simple button press programming without needing any other equipment (e.g. central hub, processor, computer, or other smart device).
   3. Wireless hub adds the ability to set up the system using any smart device with a web browser (e.g. smartphone, tablet, PC, or laptop).
   4. System does not require a factory technician to set up or program the system.
   5. Capable of diagnosing system communications.
   6. Capable of having addresses automatically assigned to them.
   7. Receives signals from other wireless devices and provides feedback to user.
   8. Capable of determining which devices have been addressed.
   9. RF Range: 60 feet (18 m) line-of-sight or 30 feet (9 m) through typical construction materials between RF transmitting devices and compatible RF receiving devices.
   10. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 15, for Class B application.

H. Wireless Network:

   1. RF Frequency: 434 MHz; operate in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.
      a. Wireless sensors, wireless wall stations and wireless load control devices do not operate in the noisy 2.4 GHz frequency band where high potential for RF interference exists.
      b. Wireless devices operate in an uncongested frequency band providing reliable operation.
      c. Fixed network architecture ensures all associated lights and load controls respond in a simultaneous and coordinated fashion from a button press, sensor signal, or command from the wireless hub (i.e. no popcorning).

2. Distributed Architecture: Local room devices communicate directly with each other. If the wireless hub is removed or damaged, local control, sensing, and operation continues to function without interruption.
3. Local room devices communicate directly with each other (and not through a central hub or processor) to ensure:
    a. Reliability of system performance.
    b. Fast response time to events in the space (e.g. button presses or sensor signals).
    c. Independent operation in the event of the wireless hub being removed or damaged.

I. Device Finishes:

1. Wall Controls: To be selected by Architect.
2. Standard Colors: Comply with NEMA WD1 where applicable.
3. Color Variation in Same Product Family: Maximum delta E of 1, CIE L*a*b color units.
4. Visible Parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

2.3 WIRELESS SENSORS

A. General Requirements:

1. Operational life of 10 years without the need to replace batteries when installed per manufacturer's instructions.
2. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.
3. Does not require external power packs, power wiring, or communication wiring.
4. Capable of being placed in test mode to verify correct operation from the face of the unit.

B. Wireless Occupancy/Vacancy Sensors:

1. General Requirements:
    a. Provides a clearly visible method of indication to verify that motion is being detected during testing and that the unit is communicating to compatible RF receiving devices.
    b. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
    c. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions; Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
    d. Provide optional, readily accessible, user-adjustable controls for timeout, automatic/manual-on, and sensitivity.
    e. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
    f. Capable of turning dimmer's lighting load on to an optional locked preset level selectable by the user. Locked preset range to be selectable on the dimmer from 1 percent to 100 percent.
    g. Color: White.
    h. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
    i. Provide temporary mounting means for drop ceilings to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.
    j. Sensor lens to illuminate during test mode when motion is detected to allow installer to place sensor in ideal location and to verify coverage prior to permanent mounting.
    k. Ceiling-Mounted Sensors:
        1) Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.

2) Provide recessed mounting bracket compatible with drywall and compressed fiber ceilings.

l. Wall-Mounted Sensors: Provide wall or corner mounting brackets compatible with drywall and plaster walls.

2. Wireless Combination Occupancy/Vacancy Sensors:
   a. Ceiling-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), an occupancy sensor with low light feature (automatic-on when less than one footcandle of ambient light available and automatic-off), or a vacancy sensor (manual-on and automatic-off).
   b. Wall-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), or a vacancy sensor (manual-on and automatic-off).
   c. Product(s):
      1) Ceiling-Mounted Occupancy/Vacancy Sensor; Lutron Radio Powr Savr Series, Model LFR2-OCR2B-P-WH: Coverage from 324 square feet (30.2 sq m) to 676 square feet (62.4 sq m) depending on ceiling height from 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view.
      2) Wall-Mounted Occupancy/Vacancy Sensor; Lutron Radio Powr Savr Series, Model LFR2-OWLB-P-WH: Minor motion coverage of 1500 square feet (139.4 sq m) and major motion coverage of 3000 square feet (278.7 sq m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); 180 degree field of view.
      3) Corner-Mounted Occupancy/Vacancy Sensor; Lutron Radio Powr Savr Series, Model LFR2-OKLB-P-WH: Minor motion coverage of 1225 square feet (113.8 sq m) and major motion coverage of 2500 square feet (232.3 sq m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); 90 degree field of view.

2.4 LOAD CONTROL MODULES

A. Provide wireless load control modules as indicated or as required to control the loads as indicated.

B. Junction Box-Mounted Modules:
   1. Plenum rated.
   2. 0-10 V Dimming Modules:
      a. Product(s):
         1) 8 A dimming module with 0-10V control, without emergency lighting mode; Lutron PowPak Dimming Module Model RMJS-8T-DV-B.

      b. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
      c. Single low voltage dimming module with Class 1 or Class 2 isolated 0-10V output signal conforming to IEC 60929 Annex E.2; source or sink automatically configures.
      d. Selectable minimum light level.
      e. Configurable high- and low-end trim.
      f. Relay: Rated for 0-10 V ballasts, LED drivers, or fixtures that conform with NEMA 410.

2.5 WIRELESS CONTROL STATIONS

A. Product(s):
   1. 2-Button Control; Lutron Pico Wireless Control Model PJ2-2B.
   2. 2-Button with Raise/Lower Control; Lutron Pico Wireless Control Model PJ2-2BRL.
   3. 3-Button Control; Lutron Pico Wireless Control Model PJ2-3B.
   4. 3-Button with Raise/Lower Control; Lutron Pico Wireless Control Model PJ2-3BRL.
   5. 4-Button; Lutron Pico Wireless Control Model PJ2-4B.
      a. Button Marking: Zone controls (light); Scene keypads (light); 2-group controllers (lights); 4-group toggle; As indicated on drawings.
   6. Pedestals as required to accommodate device.
   7. Screw Mounting Kit as required.
   8. Wallbox Adapteras required.

B. Quantity: As indicated on the drawings and approved by manufacturer.

C. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.

D. Does not require external power packs, power or communication wiring.

E. Allows for easy reprogramming without replacing unit.

F. Button Programming:
   1. Single action.
   2. Toggle action.

G. Includes LED to indicate button press or programming mode status.

H. Mounting:
   1. Capable of being mounted with a table stand or directly to a wall under a faceplate.
   2. Faceplates: Provide concealed mounting hardware.

I. Power: Battery-operated with minimum ten-year battery life (3-year battery life for night light models).

J. Finish: To be selected by Architect.

2.6 WIRELESS HUBS

A. Product(s):

   1. Wireless hub; Lutron Vive Hub.
      a. Flush-mount wireless hub; Model HJS-2-FM; Coordinate with ceiling construction.

B. Integrated multicolor LED provides feedback on what mode the hub is in for simple identification and diagnosis.

C. Integrated processor and web server allows hub to set up and operate the system without any external connections to outside processors, servers, or the internet.

D. Utilizes Ethernet connection for:
   1. Networking up to 64 hubs together to create a larger system.
   2. Remote connectivity capabilities, including maintaining system date/time and receiving periodic firmware updates (requires internet connection).

E. A single hub or network of hubs can operate on either a dedicated lighting control only network or can be integrated with an existing building network as a VLAN.

F. Communicates directly to compatible RF devices through use radio frequency communications link; does not require communication wiring; RF range of 71 feet (23 m) through walls to cover an area of 15836 square feet (1471 sq m) (device and hub must be on the same floor).

G. Communicates directly to mobile device (smartphone or tablet) or computer using built-in Wi-Fi, 2.4 GHz 802.11b/g; wireless range of 71 feet (23 m) through walls (device and hub must be on the same floor).
   1. Does not require external Wi-Fi router for connecting to the hub.

H. Allows for system setup, control, and monitoring from mobile device or computer using Vive web-based software:
   1. Supports paired devices up to maximum number indicated including compatible wireless sensors, wireless control stations, and wireless load devices.
   2. Allows for timeclock scheduling of events, both time of day and astronomic (sunrise and sunset).
      a. Timeclock is integrated into the unit and does not require a constant internet connection.
      b. Retains time and programming information after a power loss.
      c. 365-day schedulable timeclock allows for:

1) Scheduling of events years in advance.
2) Setting of recurring events with exceptions on holidays.

d. Time clock events can be scheduled to:
1) Send lights to a desired level and select the fade rate desired to reach that level.
2) Adjust level lights go to when occupied.
3) Adjust level lights go to when unoccupied.
4) Enable/disable occupancy.

3. Uses RF signal strength detection to find nearby devices for quick association and programming without having to climb ladders.
a. Association and setup does not require a factory technician to perform.
4. System using wireless hub(s) can operate with or without connection to the internet.
5. Wireless hub can be firmware upgraded to provide new software features and system updates.
a. Firmware update can be done either locally using a wired Ethernet connection or Wi-Fi connection, or remotely if the wireless hub is connected to the internet.

I. Web-Based Application:
1. Accessibility and Platform Support:
a. Web-based; runs on most HTML5 compatible browsers (including Safari and Chrome).
b. Supports multiple platforms and devices; runs from a tablet, desktop, laptop, or smartphone.
c. User interface supports multi-touch gestures such as pinch to zoom, drag to pan, etc.
d. Utilizes HTTPS (industry-standard certificate-based encryption and authentication for security).
e. Multi-level Password Protected Access: Individual password protection on both the integrated Wi-Fi network and web-based software.
f. WPA2 security for Wi-Fi communication with wireless hub.
2. System Navigation and Status Reporting:
a. Area Tree View: Easy navigation by area name to view status and make programing adjustments through the software.
b. Area and device names can be changed in real time.
3. Setup app available for iOS and Android that allows for:
a. Job registration to extend product warranty.
b. Management of setup for multiple projects in different locations.
c. Creation of handoff documents that are sent directly to a facility manager via email once setup is complete.
d. Backup of wireless hub database to cloud for hub replacement.
e. Access to native help and instructions to assist user with Vive system setup.

2.7 SOFTWARE DATA AND ANALYTICS DASHBOARD

A. Control and Monitor Software:
1. General Requirements:
a. Web-based; runs on most HTML5 compatible browsers (including Internet Explorer, Chrome, and Safari).
b. Supports multiple platforms and devices; runs from a tablet, desktop, laptop, or smartphone; optimized for displays of 1024 by 768 pixels or higher.
c. User interface supports multi-touch gestures such as pinch to zoom, drag to pan, etc.
d. Utilizes HTTPS (industry-standard certificate-based encryption and authentication for security).
e. All functionality listed below must be available via a single application.
2. System Navigation and Status Reporting:
a. Performed using graphical floor plan view or a generic system layout.
b. Graphical Floor Plan View: Utilizes customized CAD based drawing of the building. Pan and zoom feature allows for easy navigation; dynamically adjusts the details presented based on zoom level.
3. Control of Lights:
a. Control and monitor zone/area lights.
1) Area lights can be monitored for on/off status from a graphical floor plan or generic system layout.

2) All lights in an area can be turned on/off (dimmable lights can also be dimmed up/down from current level).

4. Occupancy:
   a. Area occupancy can be monitored.
      1) Can be monitored graphically if a graphical floor plan has been created.
      2) Can be monitored historically in space utilization reports.
   b. Scheduled events can be created to change occupancy parameters as described under "Scheduling" below.
5. Load Shedding: View current load shed status (active/inactive) for each Vive wireless hub and enable/disable load shed for the entire building/system.
6. Scheduling: Schedule time of day and astronomic time clock events to automate functions.
   a. Scheduled events can control the following:
      1) Area light levels for all dimmable lights in an area.
      2) On/off status of all switched lights and contact-closure outputs in an area.
      3) On/off status of all switched receptacles in an area.
   b. Scheduled events can be created to change the following occupancy parameters:
      1) Enable/disable sensors.
      2) Change occupancy mode (auto-on/auto-off versus manual-on/auto-off).
      3) Adjust occupied and/or unoccupied level.
      4) For compatible individual fixture sensors, sensor timeout can be adjusted.
   c. Easily monitor and adjust scheduled events using a weekly calendar view.
7. Reporting: Provide reporting capability that allows the building manager to gather real-time and historical information about the system as follows:
   a. Energy Reports: Show a comparison of cumulative energy used over a period of time for one or more areas.
   b. Power Reports: Show power usage trend over a period of time for one or more areas.
   c. Space Utilization/Occupancy Reports: Show historical occupancy over a period of time for one or more areas using a graphical floor plan, generic system layout, and graphs and charts.
8. Administration:
   a. Users: Allows new user accounts to be created and existing user accounts to be edited.
      1) Supports Active Directory (LDAP) tying user accounts to network accounts.
   b. Area and feature access can be restricted based on login credentials.
   c. Supports up to 20 concurrent users and 10,000 user accounts.
9. Devices/Settings Adjustment:
   a. Users with appropriate permissions can navigate to the wireless hub setup screens in order to view and/or adjust specific settings for areas or devices (including load shed settings, daylighting settings, device associations and programming, occupancy settings, high-end/low-end trim settings, etc).

2.8 SOURCE QUALITY CONTROL

A. Factory Testing; Standard Factory Testing:
   1. Perform full-function factory testing on all completed assemblies. Statistical sampling is not acceptable.
   2. Perform full-function factory testing on 100 percent of all ballasts and LED drivers.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.
B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
C. Verify that mounting surfaces are ready to receive system components.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Sensor Locations:
   1. Locate sensors in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated. Where Lighting Control Manufacturer Sensor Layout and Tuning service is not specified, locate sensors in accordance with Drawings.
   2. Sensor locations indicated are diagrammatic. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage, in accordance with manufacturer's recommendations.

C. LED Light Engine/Array Lead Length: Do not exceed 100 feet (31 m).

D. Identify system components in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

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A. Manufacturer's Start-Up Service is required.

B. Manufacturer's Full-Scope Start-Up Service: Provide manufacturer's On-Site Full-Scope Start-Up Service.
   1. Manufacturer's authorized Service Representative to conduct site visit upon completion of lighting control system installation to perform system startup and verify proper operation:
      a. Authorized Service Representative to verify sensor locations, in accordance with layout provided by Lighting Control Manufacturer; Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
      b. Verify connection of power wiring and load circuits.
      c. Verify connection and location of controls.
      d. Energize wireless hubs.
      e. Associate occupancy/vacancy sensors, daylight sensors, wireless remotes, and wall stations to load control devices.
      f. Provide initial rough calibration of sensors; fine-tuning of sensors is responsibility of Contractor.
      g. Program timeclock schedules per approved sequence of operations.
      h. Configure load shed parameters per approved sequence of operations.
      i. Verify system operation control by control.
      j. Obtain sign-off on system functions.
      k. Train Owner's representative on system capabilities, operation, and maintenance, as specified in Part 3 under "Closeout Activities".

C. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.4 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

A. Demonstration:
   1. Contractor shall engage manufacturer representative and demonstrate proper operation of lighting control devices to end user representative and general contractor/construction manager, and correct deficiencies or make adjustments as directed.

B. Training:

1. Include services of manufacturer's certified service representative to perform on-site training of Owner's personnel on operation, adjustment, and maintenance of lighting control system as part of on-site system start-up services.

3.6 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION 26 09 24

SECTION 26 12 19 - PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pad-mounted, liquid-filled, medium-voltage transformers.

B. Related Requirements:

1. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" specifies installation of low-voltage wiring.
2. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding referenced by this Section.
3. Section 260529 "Hangers and Supports for Electrical Systems" specifies hangers, supports, and concrete bases referenced by this Section.
4. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs referenced by this Section.

1.2 DEFINITIONS

A. Bushing: An insulating structure including a central conductor, or providing a central passage for a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purpose of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.

B. Bushing Elbow: An insulated device used to connect insulated conductors to separable insulated connectors on dead-front, pad-mounted transformers and to provide a fully insulated connection. This is also called an "elbow connector."

C. Bushing Insert: That component of a separable insulated connector that is inserted into a bushing well to complete a dead-front, load break or nonload break, separable insulated connector (bushing).

D. Bushing Well: A component of a separable insulated connector, either permanently welded or clamped to an enclosure wall or barrier, having a cavity that receives a replaceable component (bushing insert) to complete the separable insulated connector (bushing).

E. Elbow Connector: See "bushing elbow" above.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Coordination Meeting: For pad-mounted transformer. Conduct meeting at Project site before pad-mounted transformer installation.

1. Attendees: Installers, fabricators, representatives of manufacturers, and administrants for field tests and inspections. Notify Architect and Owner's Commissioning Authority of scheduled meeting dates.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

a. If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
b. Listing criteria identified in approval letter must match specified listing criteria. UL label indicating approval of equipment's enclosure is not considered approval of equipment for intended application.
c. Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for discontinued or superseded products are unacceptable for submitted product.

2. Product Certificates: Include product certificate stating compliance with IEEE C57.12.00, signed by manufacturer or fabricator.

B. Factory test reports.

C. Shop Drawings: Prepare and submit the following:

1. Plans and elevations showing major components and features.

a. Plan view and cross section of equipment base, showing clearances, required workspace, and locations of penetrations for grounding and conduits.

2. Details of equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of field connections.
3. Single-line diagram.
4. List of materials.
5. Nameplate data.
6. Manufacturer's published time-current curves of transformer line-side fuses, with transformer damage curve, inrush curve, and thru-fault current indicated.

D. Sustainable Design Submittals:

1. Product data for sustainable design features for each type of product.

E. Field quality-control reports.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's published instructions.

B. Manufacturer's field reports for field quality-control support.

C. Field reports for voltage monitoring and adjusting.

D. Field reports for infrared scanning.

1.6 QUALIFICATIONS

A. Electrical Power Testing (EPT) Technician III: Possessing active NICET EPT Level III certification. Able to manage switching procedures, conduct tests of complex equipment, analyze test and equipment data, plan a job, and lead a team. Has experience performing NFPA 70B, IEEE, and NETA electrical tests.

B. Electrical Power Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.

1. On-site electrical testing supervisors must possess active NICET EPT Technician III certification (minimum).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Upon delivery of transformers and prior to unloading, inspect equipment for damage that may have occurred during shipment or storage.
2. Verify that tie rods and chains are undamaged and tight, and that blocking and bracing is tight. Verify that there is no evidence of load shifting in transit, and that readings from transportation shock recorders, if equipped, are within manufacturer's recommendations.
3. Verify that there is no indication of external damage and no dents or scratches in doors and sills, tank walls, radiators and fins, or termination provisions.
4. Verify that there is no evidence of insulating-liquid leakage on transformer surfaces, at weld seams, on line- or load-side bushing parts, and at transformer base.
5. Verify that there is positive pressure or vacuum on tank. Check pressure gauge; it is required to read other than zero.
6. Compare transformers and accessories received with bill of materials to verify that shipment is complete. Verify that transformers and accessories conform with manufacturer's quotation and shop drawings. If shipment is incomplete or does not comply with Project requirements, notify manufacturer in writing immediately.
7. Verify presence of polychlorinated biphenyl content labeling.
8. Unload transformers carefully, observing packing label warnings and handling instructions.
9. Open termination compartment doors and inspect components for damage or displaced parts, loose or broken connections, cracked or chipped insulators, bent mounting flanges, dirt or foreign material, and water or moisture.

B. Storage:

1. Store transformers in accordance with manufacturer's recommendations.
2. Transformers may be stored outdoors. If possible, store transformers at final installation locations on concrete pads. If dry concrete surfaces are unavailable, use pallets of adequate strength to protect transformers from direct contact with ground. Ensure that transformer is level.
3. Ensure that transformer storage location is clean and protected from severe conditions. Protect transformers from dirt, water, contamination, and physical damage. Do not store transformers in the presence of corrosive or explosive gases. Protect transformers from the weather when stored for more than three months.
4. Store transformers with compartment doors closed.
5. Regularly inspect transformers while in storage and maintain documentation of storage conditions, noting discrepancies or adverse conditions. Verify that effective pressure seal is maintained using pressure gauges. Visually check for insulating-liquid leaks and rust spots.

C. Handling:

1. Handle transformers carefully, in accordance with manufacturer's recommendations, to avoid damage to enclosure, termination compartments, base, frame, tank, and internal components. Do not subject transformers to impact, jolting, jarring, or rough handling.

2. Protect transformer termination compartments against entrance of dust, rain, and snow.
3. Transport transformers upright, to avoid internal stresses on core and coil mounting assembly and to prevent trapping air in windings. Do not tilt or tip transformers.
4. Verify that transformer weights are within rated capacity of handling equipment.
5. Use only manufacturer-recommended points for lifting, jacking, and pulling. Use lifting lugs when lifting transformers.
6. Use jacks only at corners of tank base plate.
7. Use nylon straps of same length to balance and distribute weight when handling transformers with crane.
8. Use spreaders or lifting beam to obtain vertical lift and to protect transformer from straps bearing against enclosure. Lifting cable pull angles may not be greater than 15 degrees from vertical.
9. Exercise care not to damage tank base structure when handling transformer using skids or rollers. Use skids to distribute stresses over tank base when using rollers under large transformers.

1.8 SERVICE CONDITIONS FOR ELECTRICAL EQUIPMENT

A. Usual Service Conditions: Unless unusual service conditions have been specified in "General Environmental Conditions," "Outdoor Conditions," and "Indoor Conditions" articles of Section 018116 "Facility Environmental Requirements," electrical service and distribution equipment must be suitable for operation under usual service conditions specified in applicable IEEE C57 series standards.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2.2 PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

A. Source Quality Control:

1. Factory Tests:

a. Owner may witness required factory tests. Notify Architect at least 14 days before date of tests and indicate their approximate duration.
b. Testing Administrant: Engage qualified electrical testing agency to evaluate transformer.
c. Factory Tests and Inspections: Perform the following tests and inspections on transformer, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, in accordance with IEEE C57.12.00 before delivering to site. Affix label with name and date of manufacturer's certification of system compliance.

1) Resistance.
2) Turns ratio, polarity, and phase relation.
3) Transformer no-load losses and excitation current at 100 percent of ratings.
4) Transformer impedance voltage and load loss.
5) Operation of devices.
6) Lightning impulse.
7) Low frequency.
8) Leak.
9) Perform Optional Tests:

a) Transformer no-load losses and excitation current at 110 percent of ratings.

b) Insulation power factor.
c) Applied potential, except that this test is not required for single-phase transformers or for three-phase Y-Y-connected transformers.
d) Induced potential.
e) Resistance measurements of windings on rated voltage connection and at tap extreme connections.
f) Ratios on rated voltage connection and at tap extreme connections.
g) Polarity and phase relation on rated voltage connection.
h) No-load loss at rated voltage on rated voltage connection.
i) Exciting current at rated voltage on rated voltage connection.
j) Impedance.

d. Nonconforming Work:

1) Equipment that does not pass tests and inspections will be considered defective.

e. Factory Test Reports: Compile and submit factory test and inspection reports.

B. Three-Phase, Pad-Mounted Transformers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton
b. ERMCO-ECI
c. GE Power; General Electric Company
d. Hitachi Energy USA Inc.; business of Hitachi, Ltd.
e. Howard Industries, Inc
f. Prolec GE; A Xignux and General Electric Company Joint Ventur

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:

a. Transformers, Distribution, Liquid-Filled Type, Over 600 V: UL CCN XPLH; including IEEE C57.12.00 and IEEE C57.12.28.

3. Standard Features:

a. Oil-filled, two-winding, 60 Hz, 65 deg C rise above 30 deg C average ambient, self-cooled transformer.
b. Reference Standards: IEEE C2 and IEEE C57.12.26.
c. Windings Material: Copper.
d. Surge Arresters: Comply with IEEE C62.11, Distribution Class; metal-oxide-varistor type, fully shielded, separable-elbow type, suitable for plugging into inserts provided in line-side section of transformer. Connected in each phase of incoming circuit and ahead of disconnecting device.
e. Winding Connections: Connection of windings and terminal markings must comply with IEEE C57.12.70.
f. Efficiency: Comply with 10 CFR 431, Subpart K.
g. Insulation: Transformer kVA rating must be as follows: Average winding temperature rise above 30 deg C ambient temperature must not exceed 65 deg C and 80 deg C hottest-spot temperature rise at rated kVA when tested in accordance with IEEE C57.12.90, using combination of connections and taps that give highest average winding temperature rise.
h. Tap Changer: External handle, for de-energized operation.
i. Tank: Sealed, with welded-on cover.
j. Enclosure Integrity: Comply with IEEE C57.12.28 for pad-mounted enclosures that contain energized electrical equipment in excess of 600 V that may be exposed to the public.
k. Mounting: Integral skid mounting frame, suitable to allow skidding or rolling of transformer in any direction, and with provision for anchoring frame to pad.

l. Insulating Liquids:

1) Mineral Oil: ASTM D3487, Type II, and tested for compliance with ASTM D117.
2) Less-Flammable Liquids:

a) Edible-Seed-Oil-Based Dielectric: Listed and labeled by qualified electrical testing laboratory recognized by authorities having jurisdiction as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested in accordance with ASTM D92. Liquid must be biodegradable and nontoxic, having passed Organization for Economic Co-operation and Development G.L.203 with zero mortality, and must be certified by U.S. Environmental Protection Agency as biodegradable, meeting Environmental Technology Verification requirements.
b) Biodegradable and Nontoxic Dielectric: Listed and labeled by qualified electrical testing laboratory recognized by authorities having jurisdiction as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested in accordance with ASTM D92.

m. Sound level must comply with NEMA TR 1 requirements.
n. Corrosion Protection:

1) Transformer coating system must be factory applied, complying with requirements of IEEE C57.12.28, in manufacturer's standard color green.
2) Base and Cabinets of Two Compartment Transformers: Fabricate from stainless steel in accordance with ASTM A167, Type 304 or 304L, not less than No. 13 U.S. gage. Coat transformer with manufacturer's standard green color coating complying with requirements of IEEE C57.12.28, in manufacturer's standard color.

o. Compartment Construction:

1) Double-Compartment Construction: Individual compartments for line- and load-side sections, formed by steel isolating barriers that extend full height and depth of compartments, with hinged, lift-off doors and three-point latching, with stop in open position and provision for padlocking.

p. Primary Fusing: Designed and rated to provide thermal protection of transformer by sensing overcurrent and high liquid temperature.

1) 150 kV BIL current-limiting fuses, conforming to requirements of IEEE C37.42.
2) Interrupting Rating: 50 000 A (rms sym.) at system voltage.
3) Fuse Assembly: Bayonet-type, liquid-immersed, expulsion fuses in series with liquid-immersed, partial-range, current-limiting fuses. Bayonet fuse must sense both high currents and high oil temperature to provide thermal protection to transformer.
4) Provide bayonet fuse assembly with oil retention valve and external drip shield inside housing to eliminate or minimize oil spills. Valve must close when fuse holder is removed and external drip shield is installed.
5) Provide conspicuously displayed warning adjacent to bayonet fuse(s), cautioning against removing or inserting fuses unless transformer has been de-energized and tank pressure has been released.

q. Line-Side Section: Dead-front design.

1) To connect primary cable, use separable insulated connectors; coordinated with and complying with existing medium voltages cables. Bushings must be one-piece units, with ampere and BIL ratings same as connectors.

2) Bushing inserts:

a) Conform to requirements of IEEE 386.
b) Rated at 200 A, with voltage class matching connectors. Provide parking stand near bushing wells.
c) Provide insulated protective caps for insulating and sealing out moisture from unused bushing inserts.

3) Bushing wells configured for loop-feed application.
4) Access to liquid-immersed fuses.
5) Dead-front surge arresters.
6) Tap-changer operator.
7) Ground pad.

r. Load-Side Section:

1) Bushings with spade terminals drilled for terminating number of conductors indicated on the Drawings, and lugs that comply with requirements of Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

s. Capacities and Characteristics:

1) Power Rating: 225 kVA.
2) Voltage Ratings: 2400 V - 480Y/277 V.
3) Taps: Comply with IEEE C57.12.26 requirements.
4) Transformer BIL (kV): 25kV.
5) Minimum Tested Impedance (Percent) at 85 deg C: 4.03.

t. Transformer Accessories:

1) Drain and filter connection.
2) Filling and top filter press connections.
3) Pressure-vacuum gauge.
4) Dial-type analog thermometer with alarm contacts.
5) Magnetic liquid level indicator with high and low alarm contacts.
6) Automatically resetting pressure-relief device. Device flow must be as recommended by manufacturer.
7) Stainless steel ground connection pads.
8) Machine-engraved nameplate, made of anodized aluminum or stainless steel.
9) Sudden pressure relay for remote alarm or trip when internal transformer pressure rises at field-set rate. Provide without seal-in delay.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and space conditions for compliance with requirements for pad-mounted, liquid-filled, medium-voltage transformers and other conditions affecting performance of the Work.

B. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements.
2. Entries are within conduit-entry tolerances specified by manufacturer, and no feeders will cross section barriers to reach load or line lugs.

C. Examine concrete bases for suitable conditions for transformer installation.

D. Preinstallation Checks:

1. Verify removal of shipping bracing after placement.
2. Remove sample of insulating liquid in accordance with ASTM D923. Insulating-liquid values must comply with NETA ATS, Table 100.4. Sample must be tested for the following:

    a. Dielectric Breakdown Voltage: ASTM D877 or ASTM D1816.
    b. Acid Neutralization Number: ASTM D974.
    c. Specific Gravity: ASTM D1298.
    d. Interfacial Tension: ASTM D971.
    e. Color: ASTM D1500.
    f. Visual Condition: ASTM D1524.
    g. Water in Insulating Liquids: Comply with ASTM D1533.
    h. Power Factor or Dissipation Factor: ASTM D924.

E. Verify that grounding and bonding connections are in place. Ground (Earth) resistance may not exceed 5 Ω at transformer location.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Maintenance: NFPA 70B.
3. Electrical Safety: NFPA 70E.
4. Commissioning of Electrical Systems: NECA NEIS 90.
5. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
6. Communications Work: BICSI N1.
7. Emergency and Standby Power Work: NFPA 110, NFPA 111, and NECA NEIS 416.
8. Work in Confined Spaces: NFPA 350.
9. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
10. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Install transformers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 260529 "Hangers and Supports for Electrical Systems."
2. Transformer must be installed level and plumb and must tilt less than 1.5 degrees while energized.
3. Maintain minimum clearances and workspace at equipment in accordance with manufacturer's published instructions and IEEE C2.

D. Grounding and Bonding:

1. For counterpoise, use tinned bare copper cable not smaller than 4/0 AWG, buried not less than 30 inch below grade interconnecting grounding electrodes. Bond surge arrester and neutrals directly to transformer enclosure and then to grounding electrode system with bare copper conductors, sized as shown. Keep lead lengths as short as practicable, with no kinks or sharp bends.
2. Make joints in grounding conductors and loops by exothermic weld or compression connector.
3. Terminate grounding and bonding conductors on common equipment grounding terminal on transformer enclosure.

4. Complete transformer tank grounding and lightning arrester connections prior to making other electrical connections.

E. Connect low-voltage wiring.

1. Maintain air clearances between energized live parts and between live parts and ground for exposed connections in accordance with manufacturer recommendations.
2. Bundle associated phase, neutral, and equipment grounding conductors together within transformer enclosure. Arrange conductors such that there is not excessive strain that could cause loose connections. Allow adequate slack for expansion and contraction of conductors.

F. Terminate medium-voltage cables in incoming section of transformers.

G. Interfaces with Other Work:

1. Identification: Provide labels for transformers and associated electrical equipment.

a. Identify field-installed conductors, interconnecting wiring, and components.
b. Label each enclosure with engraved metal or laminated-plastic nameplate.
c. Provide warning signs and arc-flash hazard warning labels for electrical equipment.

2. Install transformers on cast-in-place concrete equipment base(s).
3. Provide vibration isolation and seismic control devices, if required.

3.3 FIELD QUALITY CONTROL

A. Administrant for Electrical Power Tests and Inspections:

1. Engage qualified electrical testing and inspecting agency to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
2. Administer and perform tests and inspections.

B. Field tests and inspections must be witnessed by authorities having jurisdiction.

C. Tests and Inspections:

1. General Field-Testing Requirements:

a. Comply with provisions of "Testing and Test Methods" Chapter in NFPA 70B.
b. Perform visual and mechanical inspections and electrical tests. Certify compliance with test parameters.
c. After installing transformer but before primary is energized, verify that grounding system at transformer is tested at specified value or less.
d. After installing transformer and after electrical circuitry has been energized, test for compliance with requirements.
e. Visual and Mechanical Inspection:

1) Verify equipment nameplate data complies with the Contract Documents.
2) Inspect bolted electrical connections for high resistance using one of the following two methods:

a) Use low-resistance ohmmeter to compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.
b) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or

NETA ATS, Table 100.12. Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS, Table 100.12.

2. Medium-Voltage Surge Arrester Field Tests:

   a. Visual and Mechanical Inspection:

      1) Inspect physical and mechanical condition.
      2) Verify arresters are clean.
      3) Verify that ground leads on devices are individually attached to ground bus or ground electrode.

   b. Electrical Test:

      1) Perform insulation-resistance test on arresters, phase terminal-to-ground. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Replace units that fail to comply with recommended minimum insulation resistance listed in that table.
      2) Perform watts-loss test. Evaluate watts-loss values by comparison with similar units and test equipment manufacturer's published data.

3. Liquid-Filled Transformer Field Tests:

   a. Visual and Mechanical Inspection:

      1) Test dew point of tank gases if applicable.
      2) Inspect anchorage, alignment, and grounding.
      3) Verify bushings are clean.
      4) Verify that alarm, control, and trip settings on temperature and level indicators are set and operate within manufacturer's recommended settings.
      5) Verify that liquid level in tanks is within manufacturer's published tolerances.
      6) Perform specific inspections and mechanical tests recommended by manufacturer.
      7) Verify presence of transformer surge arresters and that their ratings are as specified.
      8) Verify that as-left tap connections are as specified.

   b. Electrical Tests:

      1) Perform insulation-resistance tests winding-to-winding and windings-to-ground. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index; value of index may not be less than 1.0.
      2) Perform power-factor or dissipation-factor tests on windings in accordance with test equipment manufacturer's published data. Maximum winding insulation power-factor/dissipation-factor values must be in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.3.
      3) Measure core insulation resistance at 500 V(dc) if core is insulated and core ground strap is removable. Core insulation-resistance values may not be less than 1 MΩ at 500 V(dc).
      4) Perform power-factor or dissipation-factor tip-up test on windings greater than 2.5 kV.
      5) Perform Optional Field Tests:

         a) Perform turns-ratio tests at tap positions. Turns-ratio test results may not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.

b) Perform excitation-current test on each phase. Typical excitation-current test data pattern for three-legged core transformer is two similar current readings and one lower current reading. Investigate and correct if test shows different pattern.
c) Measure resistance of windings at tap connections, and record temperature-corrected winding-resistance values in Operations and Maintenance Manual.
d) Perform applied-voltage test on line- and load-side windings-to-ground. Comply with IEEE C57.12.91, Sections 10.2 and 10.9. This test is not required for single-phase transformers and for three-phase wye-wye-connected transformers.

6) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
7) Remove sample of insulating liquid in accordance with ASTM D923, and perform dissolved-gas analysis in accordance with IEEE C57.104 or ASTM D3612.

D. Nonconforming Work:

1. Equipment and devices will be considered defective if they do not pass tests and inspections.
2. Remove and replace malfunctioning units and retest.

E. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports. Record as-left set points of adjustable devices.

F. Manufacturer Services: Engage factory-authorized service representative to support field tests and inspections.

1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at the Project site.

3.4 CLOSEOUT ACTIVITIES

A. Training:

1. Train Owner's maintenance personnel on the following topics:

a. How to adjust, operate, and maintain transformer equipment.

2. Allow Owner to record training sessions.

3.5 PROTECTION

A. After installation, protect transformer from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.6 MAINTENANCE

A. Voltage Monitoring and Adjusting: After Substantial Completion, if requested by Owner, but not more than six months after Final Acceptance, perform the following voltage monitoring:

1. During period of normal load cycles as evaluated by Owner, perform seven days of three-phase voltage recording at outgoing section of transformers. Use voltmeters with calibration traceable to National Institute of Science and Technology standards and with chart speed of not less than

1 inch per hour. Voltage unbalance greater than 1 percent between phases, or deviation of phase voltage from nominal value by more than plus or minus 5 percent during test period, is unacceptable.

2. Corrective Action: If test results are unacceptable, perform the following corrective action, as appropriate:

    a. Adjust transformer taps.
    b. Prepare written request for voltage adjustment by electric utility.

3. Retests: Repeat monitoring, after corrective action is performed, until satisfactory results are obtained.
4. Field Reports for Voltage Monitoring and Adjusting: Prepare written report covering monitoring performed and corrective action taken.

B. Infrared Scanning of Transformers: Perform survey during periods of maximum possible loading. Remove necessary covers prior to inspection.

1. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of transformer's electrical power connections. Remove covers so joints and connections are accessible to portable scanner. Take visible light photographs at same locations and orientations as infrared scans for documentation to ensure follow-on scans match same conditions for valid comparison.
2. Instrument: Inspect distribution systems with imaging equipment capable of detecting minimum temperature difference of 1 deg C at 30 deg C. Provide documentation of device calibration.
3. Field Reports for Infrared Scanning: Prepare certified report that identifies transformer equipment checked, testing technician, and equipment used, and that describes scanning results. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action. List results as follows:

    a. Description of equipment to be tested.
    b. Discrepancies.
    c. Temperature difference between area of concern and reference area.
    d. Probable cause of temperature difference.
    e. Areas inspected. Identify inaccessible and unobservable areas and equipment.
    f. Identify load conditions at time of inspection.
    g. Provide photographs and thermograms of deficient area.

4. Act on inspection results in accordance with recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.

END OF SECTION 261219

SECTION 26 22 00 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Distribution, dry-type transformers rated 600 V and less, with capacities up to 1500 kVA.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For transformers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Qualification Data: For testing agency.

C. Source quality-control reports.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Power Transmission & Distribution, Inc.
4. Square D; by Schneider Electric.

B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Transformers Rated 15 kVA and Larger: Comply with NEMA TP 1 energy-efficiency levels as verified by testing according to NEMA TP 2.

D. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

E. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Aluminum or Copper.

F. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.

G. Shipping Restraints: Paint or otherwise color code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70, and list and label as complying with UL 1561.

B. Provide transformers that are constructed to withstand seismic forces specified in Section 26 05 48.16 "Seismic Controls for Electrical Systems."

C. Cores: One leg per phase.

D. Enclosure: Ventilated.

1. NEMA 250, Class for environment is installed.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.

E. Transformer Enclosure Finish: Comply with NEMA 250.

1. Finish Color: Gray.

F. Taps for Transformers 7.5 to 24 kVA: Two 5 percent taps below rated voltage.

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

H. Insulation Class, Smaller than 30 kVA: 185 deg C, UL-component-recognized insulation system with a maximum of 115-deg C rise above 40-deg C ambient temperature.

I. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150-deg C rise above 40-deg C ambient temperature.

J. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
2. Indicate value of K-factor on transformer nameplate.
3. Unit shall meet requirements of NEMA TP 1 when tested according to NEMA TP 2 with a K-factor equal to one.

K. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
2. Include special terminal for grounding the shield.

L. Neutral: Rated 200 percent of full load current for K-factor rated transformers.

M. Wall Brackets: Manufacturer's standard brackets.

N. Fungus Proofing: Permanent fungicidal treatment for coil and core.

O. Low-Sound-Level Requirements: Maximum sound levels when factory tested according to IEEE C57.12.91. NEMA ST 1-4 and ANSI C89.1 standard sound levels.

2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 26 05 53 "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.

1. Resistance measurements of all windings at the rated voltage connections and at all tap connections.
2. Ratio tests at the rated voltage connections and at all tap connections.
3. Phase relation and polarity tests at the rated voltage connections.
4. No load losses, and excitation current and rated voltage at the rated voltage connections.
5. Impedance and load losses at rated current and rated frequency at the rated voltage connections.
6. Applied and induced tensile tests.
7. Regulation and efficiency at rated load and voltage.
8. Insulation Resistance Tests:

    a. High-voltage to ground.
    b. Low-voltage to ground.
    c. High-voltage to low-voltage.

9. Temperature tests.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.

B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

C. Construct concrete bases according to Section 03 30 00 "Cast-in-Place Concrete" or Section 03 30 53 "Miscellaneous Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions and requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems."

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

D. Secure transformer to concrete base according to manufacturer's written instructions.

E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS for dry-type, air-cooled, low-voltage transformers. Certify compliance with test parameters.

E. Remove and replace units that do not pass tests or inspections and retest as specified above.

F. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 22 00

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Electronic-grade panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.

6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
    b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Construction Manager's written permission.
3. Comply with NFPA 70E.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

D. Enclosures: Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

    a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    b. Outdoor Locations: NEMA 250, Type 3R.
    c. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
    d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Height: 84 inches (2.13 m) maximum.
3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
7. Finishes:

   a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   b. Back Boxes: Galvanized steel.
   c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

E. Incoming Mains:

1. Location: Top and bottom.
2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

F. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.

   a. Plating shall run entire length of bus.
   b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
5. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and listed and labeled by an NRTL acceptable to authority having jurisdiction, as suitable for nonlinear loads in electronic-grade panelboards and others designated on Drawings. Connectors shall be sized for double-sized or parallel conductors as indicated on Drawings. Do not mount neutral bus in gutter.

G. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Compression type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Compression type, with a lug on the bar for each pole in the panelboard.
6. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

7. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.
8. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

H. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

I. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.2 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

D. Mains: Circuit breaker or lugs only.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Plug-in, Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Single row of overcurrent devices with narrow gutter extension with cover and overhead junction box equipped with ground and neutral terminal buses.

1. Doors: Concealed hinges secured with multipoint latch with tumbler lock; keyed alike.

2.4 ELECTRONIC-GRADE PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

D. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.

E. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.
c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:

a. Field-Adjustable Settings:

1) Instantaneous trip.
2) Long- and short-time pickup levels.
3) Long and short time adjustments.
4) Ground-fault pickup level, time delay, and I squared T response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Subfeed Circuit Breakers: Vertically mounted.
9. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Breaker handle indicates tripped status.
    c. UL listed for reverse connection without restrictive line or load ratings.
    d. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
    e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
    i. Auxiliary Contacts: One, SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    j. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
    k. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
    l. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
    m. Multipole units enclosed in a single housing with a single handle or factory assembled to operate as a single unit.
    n. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
    o. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Section 26 28 13 "Fuses."
2. Fused Switch Features and Accessories:

    a. Standard ampere ratings and number of poles.
    b. Mechanical cover interlock with a manual interlock override, to prevent the opening of the cover when the switch is in the on position. The interlock shall prevent the switch from being turned on with the cover open. The operating handle shall have lock-off means with provisions for three padlocks.
    c. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

2.6 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

1.

C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.7 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NEMA PB 1.1.

D. Equipment Mounting:

1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
2. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Comply with mounting and anchoring requirements specified in Section 26 05 48.16 "Seismic Controls for Electrical Systems."

G. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

H. Mount panelboard cabinet plumb and rigid without distortion of box.

I. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

J. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.

K. Mount surface-mounted panelboards to steel slotted supports [5/8 inch (16 mm)] [1 1/4 inch (32 mm)] in depth. Orient steel slotted supports vertically.

L. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.
2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

M. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

N. Install filler plates in unused spaces.

O. Stub four 1-inch (27-EMT) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-EMT) empty conduits into raised floor space or below slab not on grade.

P. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

Q. Mount spare fuse cabinet in accessible location.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads[after balancing panelboard loads]; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73 "Overcurrent Protective Device Coordination Study."

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.
2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard-grade receptacles, 125 V, 20A.
2. USB receptacles.
3. GFCI receptacles, 125 V, 20 A.
4. SPD receptacles, 125 V, 20 A.
5. Twist-locking receptacles.
6. Pendant cord-connector devices.
7. Cord and plug sets.
8. Toggle switches, 120/277 V, 20A.
9. Decorator-style devices, 20A.
10. Occupancy sensors.
11. Digital timer light switches.
12. Wall-box dimmers.
13. Wall plates.
14. Floor service fittings.
15. Poke-through assemblies.
16. Prefabricated multioutlet assemblies.
17. Service poles.

1.3 DEFINITIONS

A. AFCI: Arc-fault circuit interrupter.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protective device.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Service/Power Poles: [One for every 10] <Insert quantities>, but no fewer than [one] <Insert number>.
2. Floor Service-Outlet Assemblies: [One for every 10] <Insert quantities>, but no fewer than [one] <Insert number>.
3. Poke-Through, Fire-Rated Closure Plugs: [One for every five] <Insert quantities> floor service outlets installed, but no fewer than [two] <Insert number>.
4. SPD Receptacles: [One for every 10] <Insert quantities> of each type installed, but no fewer than [two of each type] <Insert number>.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Comply with NEMA WD 1.

E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with requirements in this Section.

F. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

G. Device Color:

1. Wiring Devices Connected to Normal Power System: Color to be selected under submittal phase of project, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Essential Electrical System: Red
3. SPD Devices: Blue.
4. Isolated-Ground Receptacles: Orange

H. Wall Plate Color: For plastic covers, match device color.

I. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A:
1. Manufacturers:
   a. Cooper Wiring Devices
   b. Hubbell, Inc.; Wiring Devices Div.
   c. Leviton Manufacturing.
   d. Pass & Seymour/Legrand; Wiring Devices Div.
2. Description: Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 and FS W-C-596.

B. Isolated-Ground Duplex Receptacles, 125 V, 20 A.
1. Manufacturers:
   a. Cooper Wiring Devices
   b. Hubbell, Inc.; Wiring Devices Div.
   c. Leviton Manufacturing.
   d. Pass & Seymour/Legrand; Wiring Devices Div.
2. Description: Straight blade; equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts. Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 and FS W-C-596.

C. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:
1. Manufacturers:
   a. Cooper Wiring Devices
   b. Hubbell, Inc.; Wiring Devices Div.
   c. Leviton Manufacturing.
   d. Pass & Seymour/Legrand; Wiring Devices Div.
2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

D. Weather-Resistant Duplex Receptacle, 125 V, 20 A
1. Manufacturers:
   a. Cooper Wiring Devices
   b. Hubbell, Inc.; Wiring Devices Div.
   c. Leviton Manufacturing.
   d. Pass & Seymour/Legrand; Wiring Devices Div.

2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498.
5. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

E. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A.
1. Manufacturers:
   a. Cooper Wiring Devices
   b. Hubbell, Inc.; Wiring Devices Div.
   c. Leviton Manufacturing.
   d. Pass & Seymour/Legrand; Wiring Devices Div.
2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.3 USB RECEPTACLES

A. USB Charging Receptacles:
1. Manufacturers:
   a. Cooper Wiring Devices
   b. Hubbell, Inc.; Wiring Devices Div.
   c. Leviton Manufacturing.
   d. Pass & Seymour/Legrand; Wiring Devices Div.
2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
3. USB Receptacles: Dual, USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
4. Standards: Comply with UL 1310 and USB 3.0 devices.

B. Tamper-Resistant Duplex and USB Charging Receptacles:
1. Manufacturers:
   a. Cooper Wiring Devices
   b. Hubbell, Inc.; Wiring Devices Div.
   c. Leviton Manufacturing.
   d. Pass & Seymour/Legrand; Wiring Devices Div.
2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
3. Line Voltage Receptacles: Two pole, three wire, and self-grounding; NEMA WD 6, Configuration 5-20R.
4. USB Receptacles: Dual USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
5. Standards: Comply with UL 498, UL 1310, USB 3.0 devices, and FS W-C-596.
6. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

2.4 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A:
1. Manufacturers:
   a. Cooper Wiring Devices
   b. Hubbell, Inc.; Wiring Devices Div.
   c. Leviton Manufacturing.

d. Pass & Seymour/Legrand; Wiring Devices Div.

2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Non-feed through.
5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

B. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:

1. Manufacturers:
   a. Cooper Wiring Devices
   b. Hubbell, Inc.; Wiring Devices Div.
   c. Leviton Manufacturing.
   d. Pass & Seymour/Legrand; Wiring Devices Div.
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Non-feed through.
5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
6. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:

1. Manufacturers:
   a. Cooper Wiring Devices
   b. Hubbell, Inc.; Wiring Devices Div.
   c. Leviton Manufacturing.
   d. Pass & Seymour/Legrand; Wiring Devices Div.
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
3. Configuration: NEMA WD 6, Configuration 5-15R.
4. Type: Non-feed through.
5. Standards: Comply with UL 498 and UL 943 Class A.
6. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.5 SPD RECEPTACLES, 125 V, 20 A

A. Duplex SPD Receptacles, 125 V, 20A

1. Manufacturers:
   a. Cooper Wiring Devices
   b. Hubbell, Inc.; Wiring Devices Div.
   c. Leviton Manufacturing.
   d. Pass & Seymour/Legrand; Wiring Devices Div.
2. Description: Two pole, three wire, and self-grounding. Integral SPD in line to ground, line to neutral, and neutral to ground. LED indicator light.
3. SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
4. Active SPD Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
5. Configuration: NEMA WD 6, Configuration 5-20R.
6. Standards: Comply with NEMA WD 1, UL 498, UL 1449, and FS W-C-596.

B. Isolated-Ground Duplex SPD Receptacles, 125 V, 20 A.

1. Manufacturers:
   a. Cooper Wiring Devices

b. Hubbell, Inc.; Wiring Devices Div.
c. Leviton Manufacturing.
d. Pass & Seymour/Legrand; Wiring Devices Div.

2. Description: Two pole, three wire, and self-grounding. Integral SPD in line to ground, line to neutral, and neutral to ground. LED indicator light.
3. SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
4. Active SPD Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
5. Grounding: Equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
6. Configuration: NEMA WD 6, Configuration 5-20R.
7. Standards: Comply with UL 498, UL 1449, and FS W-C-596.

2.6 TWIST-LOCKING RECEPTACLES

A. Twist-Lock, Single Receptacles, 120 V, 20 A:
1. Manufacturers:
a. Eaton.
b. Hubbell Incorporated.
c. Leviton.
d. Pass & Seymour/Legrand.
2. Configuration: NEMA WD 6, Configuration L5-20R.
3. Standards: Comply with UL 498.

B. Twist-Lock, Single Receptacles, 277 V, 20 A:
1. Manufacturers:
a. Eaton.
b. Hubbell Incorporated.
c. Leviton.
d. Pass & Seymour/Legrand.
2. Configuration: NEMA WD 6, Configuration L7-20R.
3. Standards: Comply with UL 498.

2.7 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector, heavy-duty grade.

B. Manufacturers:
1. Eaton.
2. Hubbell Premise Wiring.
3. Leviton.
4. Pass & Seymour/Legrand.

C. Configuration: NEMA WD 6, Configurations L5-20P and L5-20R.

D. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.

E. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector with strain relief.

F. Standards: Comply with FS W-C-596.

2.8 CORD AND PLUG SETS

A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.

B. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.

C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 TOGGLE SWITCHES, 120/277 V, 20 A

A. Manfuacturers:
1. Eaton.
2. Hubbell Incorporated.
3. Leviton.
4. Pass & Seymour/Legrand.

B. Single-Pole Switches, 120/277 V, 20 A:
1. Standards: Comply with UL 20 and FS W-S-896.

C. Two-Pole Switches, 120/277 V, 20 A:
1. Comply with UL 20 and FS W-S-896.

D. Three-Way Switches, 120/277 V, 20 A:
1. Comply with UL 20 and FS W-S-896.

E. Four-Way Switches, 120/277 V, 20 A:
1. Standards: Comply with UL 20 and FS W-S-896.

F. Key-Operated, Single-Pole Switches, 120/277 V, 20 A:
1. Description: Factory-supplied key in lieu of switch handle.
2. Standards: Comply with UL 20 and FS W-S-896.

G. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 20 A:
1. Description: For use with mechanically held lighting contactors.
2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

H. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 20 A:
1. Description: For use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.10 OCCUPANCY SENSORS

A. Wall Switch Sensor Light Switch, Dual Technology
1. Manufacturers:
a. Wattstopper.
b. Acuity Brands.
c. Hubbell Lighting.
d. Lutron.

2. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
3. Standards: Comply with UL 20.

4. Connections: Provisions for connection to BAS.
5. Connections: RJ-45 communications outlet.
6. Rated 10 A at 120 V ac or 10 A at 277 V ac for LED lighting, and 1/4 hp at 120 V ac.
7. Integral relay for connection to BAS.
8. Adjustable time delay.
9. Manual On mode.
10. Automatic Light-Level Sensor.

B. Wall Sensor Light Switch, Passive Infrared
1. Manufacturers:
   a. Wattstopper.
   b. Acuity Brands.
   c. Hubbell Lighting.
   d. Lutron.
2. Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using passive infrared technology.
3. Standards: Comply with UL 20.
4. Connections: Provisions for connection to BAS.
5. Connections: RJ-45 communications outlet.
6. Rated 10 A at 120 V ac or 10 A at 277 V ac for LED lighting, and 1/4 hp at 120 V ac.
7. Integral relay for connection to BAS.
8. Adjustable time delay.
9. Manual On mode.
10. Automatic Light-Level Sensor.

C. Wall Sensor Light Switch, Ultrasonic
1. Manufacturers:
   a. Wattstopper.
   b. Acuity Brands.
   c. Hubbell Lighting.
   d. Lutron.
2. Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using ultrasonic technology.
3. Standards: Comply with UL 20.
4. Connections: Provisions for connection to BAS.
5. Connections: RJ-45 communications outlet.
6. Rated 10 A at 120 V ac or 10 A at 277 V ac for LED lighting, and 1/4 hp at 120 V ac.
7. Integral relay for connection to BAS.
8. Adjustable time delay.
9. Manual On mode.
10. Automatic Light-Level Sensor.

2.11 TIMER LIGHT SWITCH

A. Digital Timer Light Switch
1. Manufacturers:
   a. Wattstopper.
   b. Acuity Brands.
   c. Hubbell Lighting.
   d. Lutron.
2. Description: Switchbox-mounted, combination digital timer and conventional switch lighting-control unit, with backlit digital display, with selectable time interval.
3. Standards: Comply with UL 20.
4. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.

5. Integral relay for connection to BAS.

2.12 DIMMERS

A. Wall-Box Dimmers:
   1. Manufacturers:
      a. Wattstopper.
      b. Acuity Brands.
      c. Hubbell Lighting.
      d. Lutron.
   2. Description: Modular, full-wave, solid-state dimmer switch with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
   3. Control: Continuously adjustable with single-pole or three-way switching. Refer to drawings.
   4. Standards: Comply with UL 1472.
   5. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.13 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
   3. Material for Unfinished Spaces: Galvanized steel.
   4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
   5. Receptacle covers in Mechanical spaces, electrical spaces and kitchens shall be stainless steel.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.14 FLOOR SERVICE FITTINGS

A. Flush-Type Floor Service Fittings:
   1. Manufacturers:
      a. Eaton.
      b. Hubbell Premise Wiring.
      c. Thomas & Betts.
      d. Wiremold/Legrand.
   2. Description: Type: Modular, flush-type, dual-service units suitable for wiring method used, with cover flush with finished floor.
   3. Compartments: Barrier separates power from voice and data communication cabling.
   4. Service Plate and Cover: Round, die-cast aluminum with satin finish, unless otherwise noted.
   5. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
   6. Data Communication Outlet: Refer to requirements in "Communications Copper Horizontal Cabling" specification.

B. Flap-Type Service Fittings:
   1. Manufacturers:
      a. Eaton
      b. Hubbell Premise Wiring.

c. Thomas & Betts.
d. Wiremold/Legrand.

2. Description: Type: Modular, flap-type, dual-service units suitable for wiring method used, with flaps flush with finished floor.
3. Compartments: Barrier separates power from voice and data communication cabling.
4. Flaps: Round, die-cast aluminum with satin finish, unless otherwise noted.
5. Service Plate: Same finish as flaps.
6. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
7. Data Communication Outlet: Refer to requirements in "Communications Copper Horizontal Cabling" specification.

C. Above-Floor Service Fittings:
1. Manufacturers:
a. Eaton.
b. Hubbell Premise Wiring.
c. Thomas & Betts.
d. Wiremold/Legrand.
2. Description: Type: Modular, above-floor, dual-service units suitable for wiring method used.
3. Compartments: Barrier separates power from voice and data communication cabling.
4. Service Plate: Rectangular, die-cast aluminum with satin finish, unless otherwise noted.
5. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
6. Data Communication Outlet: Refer to requirements in "Communications Copper Horizontal Cabling" specification.

2.15 POKE-THROUGH ASSEMBLIES

A. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.

B. Manufacturers:
1. Hubbell Incorporated.
2. Pass & Seymour.
3. Square –D.
4. Thomas & Betts.
5. Wiremold/Legrand.

C. Standards: Comply with scrub water exclusion requirements in UL 514.

D. Service-Outlet Assembly: Receptacle requirements per drawings. Coordinate telecommunication outlets with telecommunication specifications and drawings.

E. Size: Selected to fit nominal cored holes in floor and matched to floor thickness.

F. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.

G. Closure Plug: Arranged to close unused cored openings and reestablish fire rating of floor.

H. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of [two] [four], four-pair cables that comply with requirements in Section 271513 "Communications Copper Horizontal Cabling."

2.16 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Description: Two-piece surface metal raceway, with factory-wired multioutlet harness.

B. Manufacturers:
   1. Hubbell Incorporated.
   2. Wiremold/Legrand

C. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

D. Raceway Material: Metal, with manufacturer's standard finish, unless otherwise noted.

E. Multioutlet Harness:

   1. Receptacles: 20A, 125-V, NEMA WD 6 Configuration 5-20R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
   2. Receptacle Spacing: as noted
   3. Wiring: No. 12 AWG solid, Type THHN copper.

2.17 SERVICE POLES

A. Dual-Channel Service Poles
   1. Manufacturers:
      a. Hubbell Premise Wiring
      b. Wiremold
      c. Panduit Corp.
   2. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
   3. Poles: Nominal 2.5-inch- (65-mm-) square cross-section, with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling, and with separate channels for power wiring and voice and data communication cabling.
   4. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
   5. Material: Aluminum, unless otherwise noted.
   6. Finishes: Satin-anodized aluminum, unless otherwise noted.
   7. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, balanced twisted pair data communication cables.
   8. Power Receptacles: Coordinate duplex receptacle requirements with drawings.
   9. Data Communication Outlets: Coordinate with telecommunication drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

   1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.

C. Receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Tests for Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 26 43 13 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.3 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Fifteen years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCE SUPPRESSOR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Current Technology, Inc.
2. LEA International.
3. Liebert; a brand of Emerson Electric Co.

B. SPDs: Comply with UL 1449, Type 1 and Type 2.

C. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1 and Type 2.

1. SPDs with the following features and accessories:

a. Integral disconnect switch.
b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
c. Indicator light display for protection status.
d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
e. Surge counter.

D. Comply with UL 1283.

E. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 240kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

F. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, 208Y/120 V, three-phase, four-wire circuits and 240/120 V, single—phase three wire circuits shall not exceed the following:

System Voltage	Mode	B3 Ringwave	B3/C1 Comb. Wave	C3 Comb. Wave	UL 1449 Third Edition VPR Rating
120/240 120/208	L-N	420	642	1040	800
	L-G	480	690	1300	800
	N-G	340	620	1240	800
	L-L	610	1010	1420	1200
277/480	L-N	660	910	1490	1200
	L-G	750	1068	1830	1200
	N-G	720	974	1690	1200
	L-L	960	1700	2290	1800

G. SCCR: Equal or exceed 200 kA.

H. Inominal Rating: 20 kA.

2.3 PANEL SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Current Technology, Inc.
2. LEA International.
3. Liebert; a brand of Emerson Electric Co.

B. SPDs: Comply with UL 1449, Type 1 and Type 2.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Coordinate with building power monitoring and control system.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 160 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

D. Comply with UL 1283.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V and 208Y/120 V, three-phase, four-wire circuits and 240 V/120, single-phase three-phase wire circuits shall not exceed the following:

System Voltage	Mode	MCOV	B3 Ringwave	C3 Comb. Wave	UL 1449 Third Edition VPR Rating
120/240 120/208	L-N	150	325/375	650/775	700/700
	L-G	150	400/450	650/825	700/700
	N-G	0	350/350	500/500	900/1000
	L-L	300	400/500	950/1250	900/1000
277/480	L-N	320	550/600	1125/1125	900/1000
	L-G	320	850/875	1075/1225	1200/1200
	N-G	0	700/700	900/900	1200/1500
	L-L	550	650/750	1950/2200	1800/1800

F. SCCR: Equal or exceed 200 kA.

G. Inominal Rating: 20 kA.

2.4 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

B. Outdoor Enclosures: NEMA 250, Type 3R.

2.5 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
2. Controls: Comply with wiring methods in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 26 43 13

SECTION 26 51 19 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

B. Related Requirements:

1. Division 26 lighting control specifications.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of luminaire.

G. Luminaire: Complete lighting unit, including LEDs, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Include Samples to verify finish selection for luminaires and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.

1. Lighting luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
4. Structural members to which equipment and or luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:

a. Other luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Ceiling-mounted projectors.

B. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all fixtures types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

A. Provide luminaires from a single manufacturer for each luminaire type.

B. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

C. Mockups: For fixtures indicated on lighting fixture schedule, interior luminaires, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

D. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Factory-Applied Labels: Comply with UL 1598. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles.

1. Label shall include the following fixture characteristics:
   a. CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

E. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during when secured in operating position.

G. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.
4. NEMA LE 4.
5. Recessed luminaires shall comply with NEMA LE 4.

2.2 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.

2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A 36/A 36M for carbon structural steel.
2. ASTM A 568/A 568M for sheet steel.

C. Stainless Steel:

1. 1. Manufacturer's standard grade.
2. 2. Manufacturer's standard type, ASTM A 240/240 M.

D. Galvanized Steel: ASTM A 653/A 653M.

E. Aluminum: ASTM B 209.

2.3 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

D. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

E. Wall-Mounted Luminaires:

1. Attached to structural members in walls, or provide extra support as recommended by the lighting manufacturer.
2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaires:

1. Ceiling Mount:

a. Two 5/32-inch- (4-mm-) diameter adjustable aircraft cable supports adjustable to a minimum of 10 feet (3m) in length.
b. Pendant mount with 5/32-inch- (4-mm-) diameter adjustable aircraft cable supports adjustable to minimum 10 feet (3 m) in length.
c. Hook mount.

2. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing, rod, or wire support as directed by lighting manufacturer for suspension for each unit length of luminaire chassis, including one at each end.
5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of two locations, spaced near opposite corners of luminaire.

H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

I. Comply with NECA 1.

J. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

K. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and service.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. As indicated in Lighting Control specification section.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265119

SECTION 26 52 13 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of LED and luminaire, or both.

F. Luminaire: Complete lighting unit, including LEDs, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

1. Include data on features, accessories, and finishes.
2. Include physical description of the unit and dimensions.
3. Battery and charger for light units.
4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Samples for Verification: For each type of luminaire.

1. Include Samples to verify finish selection for luminaires and accessories.

D. Product Schedule:

1. For emergency lighting units, see drawings.
2. For exit signs, see drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
4. Structural members to which equipment will be attached.
5. Size and location of initial access modules for acoustical tile.
6. Items penetrating finished ceiling including the following:

a. Other luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Ceiling-mounted projectors.
e. Sprinklers.
f. Access panels.

7. Moldings.

B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
2. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.
3. External mounted drivers or emergency battery packs: One for every 20 of each type and rating installed. Furnish at least one of each type

1.8 QUALITY ASSURANCE

A. Mockups: Where indicated lighting fixture schedule luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires and signs in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Power Unit Batteries: Five years from date of Substantial Completion. Full warranty shall apply for first year and prorated warranty for the remaining four years.
2. Warranty Period for Self-Powered Exit Sign Batteries: Five years from date of Substantial Completion. Full warranty shall apply for first year and prorated warranty for the remaining four years.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Comply with UL 1598 for fluorescent luminaires.

F. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body.
   1. Operation: Relay automatically turns luminaire on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Luminaire automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects luminaire from battery, and battery is automatically recharged and floated on charger.
   2. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
      a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
      b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   3. Battery: Sealed, maintenance-free, nickel-cadmium type.
   4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
   5. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
   6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

G. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more LED heads, remote mounted from luminaire.
   1. Operation: Relay automatically turns luminaire on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Luminaire automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects luminaire from battery, and battery is automatically recharged and floated on charger.
   2. Battery: Sealed, maintenance-free, nickel-cadmium type.
   3. Charger: Fully automatic, solid-state, constant-current type.
   4. Housing: NEMA 250, Type 1 enclosure listed for installation inside, on top of, or remote from luminaire. Remote assembly shall be located no less than half the distance recommended by the emergency power unit manufacturer, whichever is less.
   5. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   6. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   7. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
   8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.2 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:
   1. Emergency Luminaires: as indicated on Drawings.

C. Emergency Lighting Unit:
   1. Emergency Lighting Unit: as indicated on Drawings.

2. Operating at nominal voltage: As indicated on drawings.
3. Wall with universal junction box adaptor.
4. UV stable thermoplastic housing rated for damp locations.
5. Two LED heads.
6. Internal emergency power unit.

D. Remote Emergency Lighting Units:
1. Emergency Lighting Unit: as indicated on Drawings.
2. Operating nominal voltage as indicated on drawings.
3. Wall with universal junction box adaptor.
4. UV stable thermoplastic housing rated for damp locations.
5. Two LED heads.
6. External emergency power unit.

2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. Operating nominal voltage as indicated on drawings.
2. AC Operation: LEDs; 50,000 hours minimum rated life.
3. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

2.4 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally when secured in operating position.

C. Housings:

1. As indicated on drawings.

2.5 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Supports:

1. Sized and rated for luminaire and emergency power unit weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

D. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

E. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing, rod or wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Ceiling Grid Mounted Luminaires:

1. Refer to LED interior lighting specification section.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service:

1. Charge emergency power units and batteries (when applicable) a minimum of one hour and depress switch to conduct short-duration test.
2. Charge emergency power units and batteries (when applicable) a minimum of 24 hours and conduct one-hour discharge test.

3.6 ADJUSTING

A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:

1. Inspect all luminaires. Replace luminaires that are defective.

a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

2. Conduct short-duration tests on all emergency lighting.

END OF SECTION 265213

SECTION 26 56 19 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.

B. Related Requirements:

1. Division 26 lighting control specifications.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Include "BUG" rating.
6. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project, IES LM-79 AND IES LM-80.
7. Wiring diagrams for power, control, and signal wiring.
8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Include Samples to verify finish selection for luminaires and accessories.

D. Product Schedule: For luminaires and lamps. Refer to Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Structural members to which equipment and luminaires will be attached.
3. Underground utilities and structures.
4. Existing underground utilities and structures.
5. Above-grade utilities and structures.
6. Existing above-grade utilities and structures.
7. Building features.
8. Vertical and horizontal information.
9. Flag pole feature information.

B. Photometric analysis for decorative and specialty feature areas such as, i.e. monument signs, flag poles, building façade signage, monuments and feature walls.

C. Product Certificates: For each type of the following:

1. Luminaire.

D. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.

E. Source quality-control reports.

F. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Drivers: One for every 50 of each type and rating installed. Furnish at least one of each type.
2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Provide luminaires from a single manufacturer for each luminaire type.

B. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

C. Mockups: For exterior luminaires, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.10 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.11 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including luminaire support components.
b. Faulty operation of luminaires and accessories.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 5 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. UL Compliance: Comply with UL 1598 and listed for wet location.

D. CRI of and CCT of basis of design luminaire, as indicated on the drawings.

E. L70 lamp life of 50,000 hours.

F. Dimmable from 100 percent to 0 percent of maximum light output to meet local energy codes.

G. Internal driver.

H. Nominal Operating Voltage: As indicated on the drawings.

I. In-line Fusing: On the primary for each luminaire.

J. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

K. Source Limitations: Obtain luminaires from single source from a single manufacturer.

L. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 LUMINAIRE TYPES

A. Area, site, bollards, ground mounted, building mounted and specialty decorative exterior luminaires:

1. Refer to lighting fixture schedule.

2.3 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Stainless steel. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch ((3.175 mm)) minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage and coating.
c. CCT and CRI for all luminaires.

2.4 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

a. Color: Refer to Lighting Fixture Schedule.

D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

a. Color: Refer to Lighting Fixture Schedule.

2.5 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Fasten luminaire to structural support.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.

4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls, Attached to a minimum 1/8 inch (3 mm) backing plate attached to wall structural members, Attached using through bolts and backing plates on either side of wall.

F. Wiring Method: Install cables in raceways. Conceal raceways and cables.

G. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.

H. Coordinate layout and installation of luminaires with other construction.

I. Adjust luminaires that require field adjustment or aiming.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 BOLLARD LUMINAIRE INSTALLATION:

A. Align units for optimum directional alignment of light distribution.

1. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.5 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim and setback as directed by manufacturer.

B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.6 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.7 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):

a. IES LM-5.
b. IES LM-50.
c. IES LM-52.
d. IES LM-64.
e. IES LM-72.

2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

3.10 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 26 56 19

SECTION 27 00 10 - SUPPLEMENTAL REQUIREMENTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supplemental requirements generally applicable to the Work specified in Division 27.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for abbreviations and acronyms for electrical terms and units of measure, abbreviations and acronyms for electrical raceway types, abbreviations and acronyms for electrical cable types, and additional coordination drawing submittal requirements.

1.2 REFERENCES

A. Abbreviations and Acronyms for Communications:

1. LAN: Local area network.
2. PoE: Power over Ethernet.
3. POTS: Plain old telephone service. See "public switched telephone network."
4. TCP/IP: Transmission control protocol/Internet protocol.
5. WAN: Wide area network.

B. Definitions for Communications:
1. Voice over Internet Protocol (VoIP): Digital telephone packet technology that uses the internet for its transmission medium.

1.3 COORDINATION

A. Interruption of Existing Internet Service: Do not interrupt internet service to facilities occupied by Owner or others unless permitted under the following conditions:

1. Notify Architect and Owner no fewer than seven days in advance of proposed interruption of internet service.
2. Do not proceed with interruption of internet service without Owner's written permission.

1.4 INFORMATIONAL SUBMITTALS

A. Prior to commencing work, submit product data and/or shop drawings for Technology equipment, materials and systems as required in each individual Division 27 Specification section. Provide all submittals far enough in advance of scheduled dates for installation to provide sufficient time for reviews, for securing necessary approvals, for possible revisions and re-submittals, and for placing orders and securing delivery.

B. Installation Schedule for Communications Systems: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for installation of communications Work to Owner and Architect including, but not limited to, milestone dates for the following activities:

1. Submission of specified coordination drawings.
2. Submission of action submittals specified in Division 27.
3. Telephone and internet service inspection and activation.
4. System startup, testing, and commissioning activities for communications equipment.
5. Requests for special inspections.
6. Requests for inspections by authorities having jurisdiction.

C. Qualification Statements:
1. For communications cable Installer.
2. For communications on-site testing supervisor.

D. Submit product data for the following. Refer to specific Specification sections for additional requirements.

1. Contractor Qualifications
2. Copper Cabling
3. Fiber Cabling
4. Low Voltage Protection Devices
5. Faceplates
6. Modular Connectors
7. Patch Panels
8. Punch Down Blocks
9. Racks and Cable Managers
10. Cable Trays and Runways
11. Firestop Details
12. Technology Grounding System Materials
13. Security Surveillance Systems
14. Any other specified system or equipment not listed

E. Submit engineered shop drawings for specific systems where final wiring and cable routings are the responsibility of the contractor. Where project floor plans are required, refer to electronic media section for requirements obtaining electronic drawing files. Refer to specific Specifications sections for additional requirements. Systems requiring engineered shop drawings shall include (but not be limited to):

1. Security Systems

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Include the following information:

a. Manufacturer's operating specifications.
b. User's guides for software and hardware.
c. Schedule of maintenance material items recommended to be stored at Project site.
d. Detailed instructions covering operation under both normal and abnormal conditions.
e. Manufacturer's instructions for setting field-adjustable components.

f. Manufacturer's instructions for testing, adjusting, and reprogramming microprocessor controls.

1.6 QUALIFICATIONS

A. Communications Cable Installer: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" and the following:

1. Training and manufacturer certification to install, splice, and terminate communications cabling.
2. Installation Supervisor: BICSI Technician (TECH) certification.
3. Copper Installers: 30 percent of employees possess BICSI Copper Installer 2 (INSTC) certification. Remaining employees possess BICSI Installer 1 (INST1) certification.
4. Fiber Installers: 30 percent of employees possess BICSI Optical Fiber Installer 2 (INSTF) certification. Remaining employees possess BICSI Installer 1 (INST1) certification.

B. Communications Testing Agency: Entity possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.

1. On-site communications testing supervisor must have BICSI Technician (TECH) certification and documented training, and be experienced with testing communications equipment in accordance with BICSI testing standards.

C. Structural Testing and Inspecting Agency: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" with documented training and experience with testing structural concrete, seismic controls, and wind-load controls.

1.7 FIELD CONDITIONS

A. Modeling, analysis, product selection, installation, and quality control for Work specified in Division 27 must comply with requirements specified in Section 260011 "Facility Performance Requirements for Electrical."

PART 2 - PRODUCTS

2.1 SUBSTITUTION LIMITATIONS FOR COMMUNICATIONS EQUIPMENT

A. Substitution requests for communications equipment will be entertained under the following conditions:

1. Substitution requests may be submitted for consideration prior to the Communications Preconstruction Conference if accompanied by value analysis data indicating that substitution will comply with Project performance requirements while significantly increasing value for Owner throughout life of facility.
2. Contractor is responsible for sequencing and scheduling equipment procurement. After the Communications Preconstruction Conference, insufficient lead time for equipment delivery will not be considered a valid reason for substitution.

PART 3 - EXECUTION

3.1 INSTALLATION OF COMMUNICATIONS WORK

A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' instructions, comply with NFPA 70, NECA NEIS 1, and BICSI N1 for installation of Work specified in Division 27. Consult Architect for resolution of conflicting requirements.

3.2 FIELD QUALITY CONTROL

A. Administrant for Communications Tests and Inspections:

1. Administer and perform tests and inspections with assistance of factory-authorized service representative.

3.3 CLEANING

A. At all times keep premises and building in neat and orderly condition, explicitly follow any instructions regarding storing of materials, protective measures, and disposing of debris.

B. After all tests and adjustments have been completed, clean all equipment leaving everything in working order at the completion of this work. Clean all equipment of dirt, dust, grease, oil, debris, and paint after all other trades have completed their work.

C. Upon completion of work remove all tools, equipment, and surplus materials.

END OF SECTION 27 00 10

SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Selection and installation of communications busbars.
2. Selection and installation of communications bonding conductors.
3. Selection of signal reference grids.
4. Installation of grounding and bonding for towers and antennas.

B. Related Requirements:
1. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 DEFINITIONS

A. PBB: Primary bonding busbar, located in main distribution frame room, ideally near electrical service entrance.

B. SBB: Secondary bonding busbar, located in intermediate distribution frame rooms.

C. TBB: Telecommunications bonding backbone, for connecting SBBs to PBB.

D. TBC: Telecommunications bonding conductor, for connecting PBB to intersystem bonding termination device or busbar at electrical service entrance.

1.3 ACTION SUBMITTALS

A. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.

B. Field Quality-Control Submittals:

1. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:

1. Installing wire connector on conductor.
2. Recommended torque values.

1.5 CLOSEOUT SUBMITTALS

A. Record Documentation: Project record documents in accordance with Section 017839 "Project Record Documents" must include locations of PBB and SBBs, and routing of TBC, TBBs, and BBCs.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

B. Inspect test results of grounding system measured at point of TBC connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of TBC only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF COMMUNICATIONS BUSBARS

A. Unless otherwise indicated in this Section or on Drawings, provide products specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. SBB:

1. Dimensions: 1/4 inch thick by 2 inch high.
2. Stand-Off Distance: 2 inch.

3.3 SELECTION OF COMMUNICATIONS BONDING CONDUCTORS

A. Unless otherwise indicated in this Section or on Drawings, provide products specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Communications Busbar Connections:

1. Refer to drawings for communications busbar connection requirements.

C. Cable Tray Connections:

1. Cable Tray Equipment Grounding Conductor: 6 AWG.
2. Cable Tray Bonding Jumper: If not supplied by cable manufacturer, provide bonding jumper not smaller than 6 AWG and not longer than 12 inch. If jumper must be terminated with lug having one hole and standard barrel for one crimp.
   a. spacing.

3.4 INSTALLATION OF BONDING FOR COMMUNICATIONS

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Bonding of Communications: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with BICSI N3.
2. Consult Engineer for resolution of conflicting requirements.

C. Special Techniques:

1. Busbars:

a. Install busbars horizontally, on insulated spacers as noted on drawings.

2. Conductors:

a. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
b. Assemble wire connector to conductor, complying with manufacturer's published instructions and as follows:

1) Use crimping tool and die specific to connector.
2) Pretwist conductor.
3) Apply antioxidant compound to bolted and compression connections.

c. Install in straightest and shortest route between origination and termination point, and no longer than required. Bend radius must not be smaller than 10 times diameter of conductor. No single bend may exceed 90 degrees.
d. Install without splices.
e. Support conductors at not more than 36 inch intervals.
f. Outside telecommunications rooms, install conductors in metric designator 21 (trade size 3/4) PVC-80 conduit until conduit enters telecommunications room. Install bonding conductors in EMT-A or EMT-SS when routed through plenum. Do not install bonding conductors in EMT-S unless otherwise indicated on Drawings.

1) If bonding conductor must be installed in EMT-S or other ferrous metallic raceway, bond conductor to raceway using grounding bushing that complies with Section 270528 "Pathways for Communications Systems," and bond both ends of raceway to SBB.

3.5 IDENTIFICATION

A. Comply with Section 270553 "Identification for Communications Systems."

B. Labels must be preprinted or computer-printed type.

1. Label PBB(s) with "ts-PBB," where "ts" is telecommunications space identifier for location of PBB.
2. Label SBB(s) with "ts-SBB," where "ts" is telecommunications space identifier for location of SBB.
3. Label TBC, TBBs, and BBCs at attachment points with legend: "WARNING! COMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.6 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench according to manufacturer's published instructions.
2. Test bonding connections of system using AC earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing PBB or SBB, using process recommended by BICSI N1. Conduct tests with facility in operation.

    a. Measure resistance between PBB and electrical service intersystem termination point. Maximum acceptable value is 100 mΩ.

        1) If measured resistance from electrical service equipment to ground exceeds 5 Ω, notify Engineer and include recommendations to reduce resistance to ground.

    b. Measure resistance between SBB and PBB. Maximum acceptable value is 100 mΩ.

3. Test for ground loop currents using digital clamp-on ammeter, with full scale not more than 10 A, displaying current in increments of 0.01 A at accuracy of plus or minus 2.0 percent.

    a. With grounding infrastructure completed and communications system electronics operating, measure current in bonding conductors connected to PBB and to SBBs. Maximum acceptable AC current level is 1 A.

B. Nonconforming Work:

1. Communications bonding will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

C. Collect, assemble, and submit test and inspection reports.

3.7 PROTECTION

A. After installation, protect busbars and conductors from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 27 05 26

SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Optical fiber cable pathways and fittings.
3. Hooks.
4. Boxes, enclosures, and cabinets.
5. Cable trays.
6. Cable Runways.

1.3 ACTION SUBMITTALS

A. Product data for the following:
1. Wireways and fittings.
2. Boxes, enclosures, and cabinets.
3. Cable trays.
4. Cable Runways.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.

B. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
2. Comply with TIA-569-D.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT:

    a. Material: Steel or die cast.
    b. Type: Set screw or compression.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

G. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

A. Description: Comply with UL 2024; flexible-type pathway with a circular cross section, approved for plenum installation unless otherwise indicated.

B. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

C. Comply with TIA-569-D.

2.3 HOOKS

A. Description: Prefabricated sheet metal cable supports for telecommunications cable.

B. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

C. Comply with TIA-569-D.

D. Galvanized steel.

E. J shape.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Description: Enclosures for communications.

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-D.
2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
4. Device Box Dimensions: 4-11/16 inches square by 2-1/8 inches deep.
5. Gangable boxes are prohibited.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

E. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

2.5 CABLE TRAYS - TROUGH TYPE

A. Cable trays shall be "trough" type and minimum actual loading depth shall be 4". Cable trays shall be louvered ventilated construction with louvered openings a minimum of 3" wide.

B. Straight Sections shall be one piece construction. Top flanges shall be rolled outward and downward for safety of cables and personnel. Cable bearing surface shall be 3" wide. Openings shall be on 6" centers with metal drawn downward so cables can drop out at any location along the tray-without cutting or gasketing the openings. Standard length shall be 12 feet. Width shall be as noted on the Drawings.

C. Fittings shall be 3 piece welded construction with radius of 12". Fittings shall have a 3" tangent for easy fit-up in field. Splice plates shall be made of .125" thick aluminum with a four-bolt design with slotted holes. All elevation transitions shall use 45° bend fittings, maximum.

D. Radius drop cross members shall be provided for transition of cabling to rack or cabinet.

E. Material shall be aluminum 5052H32 alloy.

F. Hardware shall be 3/8" x 3/4" 302 stainless steel serrated round head bolts. SS hex nuts shall have an integral lock washer.

G. Cable trays shall be built and tested to NEMA VE-1 and shall be UL Listed for cable trays to be used as an equipment grounding conductor.

H. Approved manufacturers shall be:
1. Chalfant Series 6
2. Or equal by B-line, Chattsworth, or Hubbell.

2.6 CABLE RUNWAYS

A. Unless otherwise noted, provide metal cable runways, of types, classes and sizes indicated with splice connectors, bolts, nuts and washers for connecting units.

B. Cable runway shall be ladder type, constructed of rectangular steel tubing with a minimum stringer height of 1½ ". The rungs shall be ½" by 1" steel welded to the stringers at 9" intervals. Color shall be black.

C. Cable runway shall be capable of carrying a uniformly distributed maximum load of 135 lbs/ft when supported every 5 ft.

D. Standard length shall be 10’. Width shall be as noted on the Drawings.

E. All fittings, supports, splices, etc. for the runway system shall be installed to provide a complete assembly- including fasteners, hardware, and other items required to complete the installation as indicated on the Drawings.

F. Radius Drops shall be used when transitioning cables from the cable runway to a rack, wall field or other cable management device. Radius Drop shall securely fasten to the rung or stringer, and shall be the same width as the cable runway.

G. Approved manufacturers shall be:
   1. Chattsworth - Telco Style Cable Runway
   2. Or equal by B-line, Chalfant, or Hubbell

2.7 CABLE TRAYS - WIRE MESH TYPE

A. Cable Trays shall be constructed of continuous, rigid, welded steel wire mesh, which shall permit continuous ventilation of cables and maximum dissipation of heat. Edges shall be constructed with a continuous safety edge T-welded wire lip and shall be welded at all intersections.

B. Cable Trays shall be UL Listed.

C. Cable Trays shall be constructed of carbon steel wire, ASTM A 510, Grade 1008, wire welded, bent, and surface treated after manufacturing.

D. Radius drop cross members shall be provided for transition of cabling to rack or cabinet.

E. The finish for the carbon steel wire shall be applied after welding and bending of mesh and shall be composed of hot-dip galvanizing ASTM A 123. Painted wire mesh cable tray shall meet NEC.

F. Nominal Dimensions:
   1. Mesh: 2 x 4 inches (50 x 100 mm)
   2. Straight Section Lengths:118 inches (3,000 mm)
   3. Width: as noted on Drawings
   4. Depth: 3 inches, unless otherwise noted
   5. Wire Diameter: 0.177 inch (4.5 mm)

G. Fittings shall not be required to be fabricated at the manufacturer. Fittings shall be fabricated in the field from straight sections in accordance with manufacturer's instructions, and shall utilize any and all specialized tools required by the manufacturer for proper installation.

H. Connecting hardware, including splice connectors and support components, shall be furnished by the manufacturer. Hardware required to maintain a continuous ground along the entire length of the tray shall be supplied by the manufacturer and installed by the Electrical Contractor.

I. Approved manufacturers shall be:
   1. Chalfant
   2. Or equal by B-line, Cablofil, or Flextray

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT or RNC.
2. Concealed in Ceilings and Interior Walls and Partitions: EMT.
3. Damp or Wet Locations: GRC.
4. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
5. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: EMT.
6. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: EMT.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel units in institutional and commercial kitchens and damp or wet locations.

B. Minimum Pathway Size: 3/4-inch trade size for copper and aluminum cables, and 1 inch for optical-fiber cables.

C. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use set-screw or compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.

D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

E. Install surface pathways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA/BICSI 568.
3. TIA-569-D.
4. NECA 101
5. NECA 102.
6. NECA 105.
7. NECA 111.

B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

D. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.

E. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling" for sleeves and sleeve seals for communications.

F. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

G. Complete pathway installation before starting conductor installation.

H. Arrange stub-ups so curved portions of bends are not visible above finished slab.

I. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

J. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches of enclosures to which attached.

L. Pathways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
3. Arrange pathways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from nonmetallic conduit and fittings to RNC, Type EPC-40-PVC, GRC or IMC and fittings before rising above floor.

M. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for pathways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

O. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

Q. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.

R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.

S. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

T. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.

U. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

V. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.

W. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

X. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

Y. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT that is located where environmental temperature change may exceed 100 deg F, and that has straight-run length that exceeds 100 feet.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Z. Hooks:

1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.

2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
3. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
4. Space hooks no more than 5 feet o.c.
5. Provide a hook at each change in direction.

AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

CC. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

FF. Set metal floor boxes level and flush with finished floor surface.

GG. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 CABLE TRAYS AND RUNWAYS

A. Provide straight sections, curved sections, hangers, support rods, clamps, related fittings and mounting accessories as recommended by the system supplier. Conflicts shall be brought to the attention of the Architect and Engineer for resolution.

B. Standard support systems shall consist of wall mounting, trapeze mounting, and under floor mounting hardware - as described on the Drawings. Trapeze systems must be supported from each side of the cable tray or runway. Center support systems are prohibited.

C. The Drawings indicate intended routings. Contractor shall provide horizontal and vertical transitions as required to suit field conditions to meet routing requirements. Any deviation from the indicated route, either due to field conditions or coordination issues, must be brought to the attention of the Technology Engineer immediately, as these may affect the design of the pathway and the subsequent cable routing. Any unapproved routing of cable tray and runways not brought to the attention of the Engineer, causing such an outcome shall be corrected, and the responsibility for this correction shall be borne by the Contractor.

D. Provide a minimum of 12" clearance above and both sides of all cable tray sections from the finished structure of any device or equipment installed or routed above the cable tray.

E. The Contractor shall coordinate these clearances and the routing of the cable tray with all other trades prior to installation and monitor the installation of the other trades during the progress of the project. The Contractor shall hold all other trades accountable to this

coordination. Any deviation by other trades to this coordination effort shall be brought to the immediate attention of the GC or CM for immediate resolution.

F. Installation shall comply with Article 392 of the National Electrical Code. Ground cable trays that support electrical conductors as required for conductor enclosures in Article 250 of the National Electrical Code. Cable tray and runway used as equipment grounding conductors shall be provided with bonding jumpers between sections, raceways, and equipment. Support of cable trays and runways shall meet NEMA Class 10A, at 6 foot support spans to support 50 pounds/foot (safety factor 1.5). The required method of mounting shall be trapeze with strut, using two 1/2" threaded rods with sections directly supported by and clamped to the strut.

G. Shop Drawings shall include product data, and layout drawings (1/16" scale minimum) indicating intended routings.

H. Contractor shall protect cabling from all sharp or rough edges or points.

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 27 05 28

SECTION 27 05 29 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Mounting, anchoring, and attachment components.
5. Fabricated metal equipment support assemblies.

1.2 ACTION SUBMITTALS

A. Product Data. For each type of product:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Slotted support systems, hardware, and accessories.
b. Clamps.
c. Hangers.
d. Sockets.
e. Eye nuts.
f. Fasteners.
g. Anchors.
h. Saddles.
i. Brackets.

2. Include rated capacities and furnished specialties and accessories.

3. Assemblies used to support communications equipment include the following:

a. Trapeze hangers. Include product data for components.
b. Steel slotted-channel systems.
c. Aluminum slotted-channel systems.
d. Nonmetallic slotted-channel systems.

4. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

B. Delegated Design Submittals: For hangers and supports for communications systems.

1. Include design calculations and details of trapeze hangers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.

2.2 STEEL SLOTTED SUPPORT SYSTEMS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
   1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
   2. Material for Channel, Fittings, and Accessories: Galvanized steel.
   3. Channel Width: Selected for applicable load criteria.
   4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   5. Channel Dimensions: Selected for applicable load criteria.

2.3 CONDUIT AND CABLE SUPPORT DEVICES

A. Conduit and Cable Support Devices: Steel clamps, hangers, and associated fittings, designed for types and sizes of raceway or cable to be supported.

2.4 SUPPORT FOR CONDUCTORS IN VERTICAL CONDUIT

A. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored communications conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

2.5 STRUCTURAL STEEL FOR FABRICATED SUPPORTS AND RESTRAINTS

A. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

2.6 MOUNTING, ANCHORING, AND ATTACHMENT COMPONENTS

A. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

   1. Powder-Actuated Fasteners: Threaded-steel stud for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   2. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.7 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA/BICSI 568.
3. TIA-569-D.
4. NECA 101.
5. NECA 102.
6. NECA 105.
7. NECA 111.

B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 INSTALLATION OF SUPPORTS

A. Raceway Support Methods: In addition to methods described in NECA 1, EMT IMC and RMC may be supported by openings through structure members, according to NFPA 70.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten communications items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Use approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Use expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated-driven threaded studs, provided with lock washers and nuts, may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor communications materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup:

1. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

    a. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 27 05 29

SECTION 27 05 44 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Round sleeves.
2. Rectangular sleeves.
3. Sleeve seal systems.
4. Grout.
5. Pourable sealants.
6. Foam sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 ROUND SLEEVES

A. Wall Sleeves, Steel:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Advance Products & Systems, LLC.
b. CCI Piping Systems.
c. Flexicraft Industries.
d. GPT; a division of EnPRO Industries.

2. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

B. Wall Sleeves, Cast Iron:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. American Cast Iron Pipe Company.
    b. Flexicraft Industries.
    c. McWane Ductile.

2. Description: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

1.5 SLEEVE SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Advance Products & Systems, LLC.
2. Flexicraft Industries.
3. GPT; a division of EnPRO Industries.
4. Metraflex Company (The).

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable or between pathway and cable.

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

1.6 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 2 - EXECUTION

2.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
b. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless sleeve seal system is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

C. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for wall assemblies.

D. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using [**steel**] [**cast-iron**] pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

2.2 INSTALLATION OF SLEEVE SEAL SYSTEMS

A. Install sleeve seal systems in sleeves in exterior concrete walls and slabs-on-grade at pathway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 27 05 44

SECTION 27 05 53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Labels.
2. Bands and tubes.
3. Underground-line warning tape.
4. Signs.
5. Cable ties.
6. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Labels.
2. Bands and tubes.
3. Underground-line warning tape.
4. Signs.
5. Cable ties.
6. Miscellaneous identification products.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for communications identification products.

C. Identification Schedule:

1. Outlets: Scaled drawings indicating location and proposed designation.
2. Backbone Cabling: Riser diagram showing each communications room, backbone cable, and proposed backbone cable designation.
3. Racks: Scaled drawings indicating location and proposed designation.
4. Patch Panels: Enlarged scaled drawings showing rack row, number, and proposed designations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 70 and TIA 606-B.

B. Comply with ANSI Z535.4 for safety signs and labels.

C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Equipment Identification Labels:

1. Black letters on a white field.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Champion America.
c. Panduit Corp.

B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceway or cable they identify, that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Marking Services Inc.
c. Panduit Corp.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- thick, polyester flexible labels with acrylic pressure-sensitive adhesive.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Ideal Industries, Inc.
c. Panduit Corp.

2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating protective shields over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
3. Marker for Labels:
a. Machine-printed, permanent, waterproof black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Ideal Industries, Inc.
c. Panduit Corp.

2. Minimum Nominal Size:

a. 1-1/2 by 6 inches for raceway and conductors.
b. 3-1/2 by 5 inches for equipment.
c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

A. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters of raceway or cable they identify, that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Marking Services Inc.
c. Panduit Corp.

2.5 UNDERGROUND-LINE WARNING TAPE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Ideal Industries, Inc.
3. Marking Services Inc.

B. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

C. Color and Printing:

1. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, and ANSI Z535.4.
2. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL-FIBER CABLE".

2.6 SIGNS

A. Baked-Enamel Signs:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brady Corporation.
   b. Carlton Industries, LP.
   c. Marking Services Inc.

2. Preprinted aluminum signs,punched or drilled for fasteners, with colors, legend, and size required for application.
3. 1/4-inch grommets in corners for mounting.
4. Nominal Size: 7 by 10 inches.

B. Metal-Backed Butyrate Signs:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brady Corporation.
   b. Champion America.
   c. Marking Services Inc.

2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
3. 1/4-inch grommets in corners for mounting.
4. Nominal Size: 10 by 14 inches.

C. Laminated-Acrylic or Melamine-Plastic Signs:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brady Corporation.
   b. Carlton Industries, LP.
   c. Marking Services Inc.

2. Engraved Legend: With black letters on white face.
3. Thickness:

   a. For signs up to 20 sq. in., minimum 1/16 inch thick.
   b. For signs larger than 20 sq. in., 1/8 inch thick.

4. Attachment: Punched or drilled for mechanical fasteners with 1/4-inch (6.4-mm) grommets in corners for mounting.
5. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ideal Industries, Inc.
2. Marking Services Inc.
3. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F According to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F According to ASTM D638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.

G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

H. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
3. Provide label 6 inches from cable end.

I. Snap-Around Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Provide label 6 inches from cable end.

J. Self-Adhesive Wraparound Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Provide label 6 inches from cable end.

K. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

L. Snap-Around, Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

M. Underground-Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

N. Cable Ties: General purpose, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

A. Coordinate the following labeling requirements with Owner to match existing labeling scheme.

B. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

C. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.

D. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation, numbered clockwise when entering room from primary egress, composed of the following, in the order listed:

1. Wiring closet designation.
2. Colon.
3. Faceplate number.

E. Equipment Room Labeling:

1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels containing equipment designation.
2. Patch Panels: Label individual rows and outlets, starting at top left and working down, with self-adhesive labels.
3. Data Outlets: Label each outlet with a self-adhesive label indicating the following, in the order listed:

    a. Room number being served.
    b. Colon.
    c. Faceplate number.

F. Backbone Cables: Label each cable with a vinyl-wraparound label indicating the location of the far or other end of the backbone cable. Patch panel or punch down block where cable is terminated should be labeled identically.

G. Horizontal Cables: Label each cable with a self-adhesive wraparound label indicating the following, in the order listed:

1. Room number.
2. Colon.
3. Faceplate number.

H. Locations of Underground Lines: Underground-line warning tape for copper, coaxial, hybrid copper/fiber, and optical-fiber cable.

I. Instructional Signs: Self-adhesive labels.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.

END OF SECTION 27 05 53

SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backboards.
2. Boxes, enclosures, and cabinets.
3. Power strips.

B. Related Requirements:
1. Section 271323 "Communications Optical Fiber Backbone Cabling" for optical-fiber data cabling associated with system panels and devices.
2. Section 271513 "Communications Copper Horizontal Cabling" for copper data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. RCDD: Registered communications distribution designer.

C. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.
2. Installation Supervision: Installation shall be under direct supervision of Installer 2, Copper or Fiber, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches.

B. Backboard Paint: Light-colored fire-retardant paint.

2.2 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets shall be listed and labeled for intended location and use.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, Type FD, ferrous alloy, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized cast iron with gasketed cover.

G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

H. Device Box Dimensions: 4-11/16” inches square by 2-1/8 inches deep.

I. Cabinets:

1. NEMA 250, Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.

5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 POWER STRIPS

A. Comply with requirements in Section 271116 "Communications Racks, Frames, and Enclosures."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI's "Telecommunications Distribution Methods Manual" for layout of communications equipment spaces.

C. Comply with BICSI's "Information Technology Systems Installation Methods Manual" for installation of equipment in communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in racks and in room.

1. Meet jointly with systems providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize configurations and space requirements of communications equipment.
4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

G. Backboards:

1. Install from 6 inches to 8 feet, 6 inches above finished floor. If plywood is fire rated, ensure that fire-rating stamp is visible after installation.
2. Paint all sides of backboard with two coats of paint, leaving fire rating stamp visible.
3. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-D.

3.2 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.3 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI's "Information Technology Systems Installation Methods Manual," "Firestopping Practices" Ch.

END OF SECTION 27 11 00

SECTION 27 11 16 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. 19-inch equipment racks.
2. Power strips.
3. Grounding.
4. Labeling.

B. Related Requirements:

1. Section 271110 "Communications Equipment Room Fittings" for backboards and accessories.
2. Section 270526 "Grounding and Bonding for Telecommunications Equipment" for TMGBs and TGBs.
3. Section 271323 "Communications Optical Fiber Backbone Cabling" for optical-fiber data cabling associated with system panels and devices.
4. Section 271513 "Communications Copper Horizontal Cabling" for copper data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. LAN: Local area network.

C. RCDD: Registered communications distribution designer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, certifications, standards compliance, and furnished specialties and accessories.

B. Shop Drawings: For communications racks, frames, and enclosures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of TGB and its mounting detail showing standoff insulators and wall-mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.
2. Installation Supervision: Installation shall be under direct supervision of Installer 2, Copper or Fiber, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform on-site inspection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. UL listed.

B. RoHS compliant.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

B. Backboard Paint: Light-colored fire-retardant paint.

2.3 19-INCH EQUIPMENT RACKS

A. Description: Two- post racks with threaded rails designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch equipment mounting with an opening of 17.72-inches between rails.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. Chatsworth Products.
3. Leviton Manufacturing Co., Inc.
4. Middle Atlantic Products; Legrand North America, LLC.

C. General Requirements:

1. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Material: Extruded aluminum.
3. Finish: Manufacturer's standard, baked-polyester powder coat.
4. Color: Black.

D. Floor-Mounted Racks:

1. Overall Height: 84 inches.
2. Overall Depth: 23 inches.
3. Upright Depth: 6 inches.
4. Two-Post Load Rating: 200 lb.
5. Number of Rack Units per Rack: 42.
6. Threads: 10-32.
7. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
8. Base shall have a minimum of four mounting holes for permanent attachment to floor.
9. Top shall have provisions for attaching to cable tray or ceiling.
10. Self-leveling.

E. Cable Management:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Rack mounting.
3. Six 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
4. LED indicator lights for power and protection status.
5. LED indicator lights for reverse polarity and open outlet ground.
6. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
7. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
8. Close-coupled, direct plug-in line cord.
9. Rocker-type on-off switch, illuminated when in on position.

2.5 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

2.6 LABELING

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout of communications equipment spaces.

C. Comply with BICSI ITSIMM for installation of communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in racks and room. Coordinate service entrance configuration with service provider.

1. Meet jointly with system providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment spaces to accommodate and optimize configuration and space requirements of telecommunications equipment.
4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.2 GROUNDING

A. Comply with NECA/BICSI 607D.

B. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Ch.

3.3 IDENTIFICATION

A. Coordinate system components, wiring, and cabling complying with TIA-606-B. Comply with requirements in Section 270553 "Identification for Electrical Systems."

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

END OF SECTION 27 11 16

SECTION 27 13 23 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Type OFNP optical fiber cable.
   2. Type OSP optical fiber cable.
   3. Optical fiber cable hardware.

1.2 DEFINITIONS

A. Conductive Cable: Cable containing non-current-carrying electrically-conductive members such as metallic strength members and metallic vapor barriers.

B. Cross-Connect: A facility enabling termination of cable elements and their interconnection or cross-connection.

C. Type OFCP: Conductive cable for use in plenums, ducts, and other spaces used for environmental air.

D. Type OFCR: Conductive cable for use as riser in vertical shafts or from floor to floor.

E. Type OFNP: Nonconductive cable for use in plenums, ducts, and other spaces used for environmental air.

F. Type OFNR: Nonconductive cable for use as riser in vertical shafts or from floor to floor.

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Type OFNP optical fiber cable.
   2. Type OSP optical fiber cable.
   3. Optical fiber cable hardware.

B. Shop Drawings:

   1. System Labeling Schedules:

      a. Electronic copy of labeling schedules, in software and format selected by Owner.

   2. Cabling administration drawings and printouts.

   3. Cross-Connect and Patch-Panel Drawings: Detail mounting assemblies and show elevations and physical relationship between installed components.

C. Field Quality-Control Reports: Optical fiber cable testing plan.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Contracts:

1. Software service agreement.

B. Maintenance Data: For optical fiber cable, splices, and connectors.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet-work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

B. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine continuity of strand end to end. Use optical fiber flashlight or optical loss test set.
2. Test optical fiber cable while on reels. Use optical time domain reflectometer to verify cable length and locate cable defects, splices, and connector, including loss value of each. Retain test data and include record in maintenance data.

PART 2 - PRODUCTS

2.1 TYPE OFNP OPTICAL FIBER CABLE

A. Type OFNP Optical Fiber Cable: This category covers jacketed optical fiber cable for use in vertical runs in plenums, ducts, or other spaces used for environmental air within buildings in accordance with Article 770 of NFPA 70 containing no electrically conductive materials.

B. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN QAYK; including UL 1651.
3. General Characteristics:

a. Performance: TIA-568.3.
b. Inside Plant Mechanical Properties: ICEA S-83-596.
c. Inside-Outside Plant Mechanical Properties: ICEA S-104-696.
d. Jacket:

1) Cable cordage jacket, fiber, unit, and group color in accordance with TIA-598.
2) Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inch.

C. Type OFNP, Designation OM4, Multimode Optical Fiber Cable:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Belden Inc.
b. CommScope, Inc.
c. Corning Optical Communications; Corning Incorporated.

2. Source Limitations: Obtain products from single manufacturer.
3. Additional Characteristics:

a. Construction: TIA-492AAAD; 850 nm laser-optimized, 50 µm core diameter, 125 µm cladding diameter.
b. Minimum Overfilled Modal Bandwidth-Length Product: 3500 MHz-km at 850 nm wavelength; 500 MHz-km at 1300 nm wavelength.
c. Minimum Effective Modal Bandwidth-Length Product: 4700 MHz-km at 850 nm wavelength.

4. Options:

a. Configuration: 12-fiber, tight buffer, optical fiber cable.
b. Maximum Attenuation: 3.50 dB/km at 850 nm wavelength; 1.5 dB/km at 1300 nm wavelength.
c. Jacket Color: Aqua.

D. Type OFNP, Designation OS2, Single-Mode Optical Fiber Cable:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Belden Inc.
b. CommScope, Inc.
c. Corning Optical Communications; Corning Incorporated.

2. Source Limitations: Obtain products from single manufacturer.
3. Additional Characteristics:

a. Construction: TIA-492CAAB; 9 µm core diameter, 125 µm cladding diameter, with low water peak.
b. Minimum Overfilled Modal Bandwidth-Length Product: 500 MHz-km at 850 nm wavelength; 500 MHz-km at 1300 nm wavelength.

4. Options:

a. Configuration: 12-fiber, single loose tube, optical fiber cable.
b. Maximum Attenuation: 0.5 dB/km at 1310 nm wavelength; 0.5 dB/km at 1550 nm wavelength.
c. Jacket Color: Yellow.

2.2 TYPE OSP OPTICAL FIBER CABLE

A. Type OSP Optical Fiber Cable: This category covers jacketed optical fiber cable for use in outdoor environments.

B. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN QAYK; including UL 1651.

Insert drawing designation. Use these designations on Drawings to identify each product.

C. Type OSP, Designation OM4, Multimode Optical Fiber Cable:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Belden Inc.
   b. CommScope, Inc.
   c. Corning Optical Communications; Corning Incorporated.

2. Source Limitations: Obtain products from single manufacturer.
3. Additional Characteristics:

   a. Construction: TIA-492AAAx; 850 nm laser-optimized, 50 µm core diameter, 125 µm cladding diameter.
   b. Minimum Overfilled Modal Bandwidth-Length Product: 1500 MHz-km at 850 nm wavelength; 500 MHz-km at 1300 nm wavelength.
   c. Minimum Effective Modal Bandwidth-Length Product: 2000 MHz-km at 850 nm wavelength.

4. Options:

   a. Configuration: 12-fiber, tight buffer, optical fiber cable.
   b. Maximum Attenuation: 3.50 dB/km at 850 nm wavelength; 1.5 dB/km at 1300 nm wavelength.
   c. Jacket Color: Aqua.

D. Type OSP, Designation OS2, Single-Mode Optical Fiber Cable:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Belden Inc.
   b. CommScope, Inc.
   c. Corning Optical Communications; Corning Incorporated.

2. Source Limitations: Obtain products from single manufacturer.
3. Additional Characteristics:

   a. Construction: TIA-492CAAx; 9 µm core diameter, 125 µm cladding diameter, with low water peak.
   b. Minimum Overfilled Modal Bandwidth-Length Product: 500 MHz-km at 850 nm wavelength; 500 MHz-km at 1300 nm wavelength.

4. Options:

   a. Configuration: 12-fiber, tight buffer, optical fiber cable.
   b. Maximum Attenuation: 0.5 dB/km at 1310 nm wavelength; 0.5 dB/km at 1550 nm wavelength.
   c. Jacket Color: Yellow.

2.3 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.

2. CommScope, Inc.
3. Corning Optical Communications; Corning Incorporated.

B. Performance Criteria:

1. Fiber Optic Connector Intermateability Standard (FOCIS) specifications of TIA-604 series.
2. TIA-568.3.

C. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

D. Patch Cords: Factory-made, dual-fiber cables in 36 inch lengths.

E. Connector Type: Type LC complying with TIA-604-10, connectors.

F. Plugs and Plug Assemblies:

1. Male; color-coded modular telecommunications connector designed for termination of single optical fiber cable.
2. Insertion loss not more than 0.75 dB.
3. Marked to indicate transmission performance.

G. Jacks and Jack Assemblies:

1. Female; quick-connect, simplex and duplex; fixed telecommunications connector designed for termination of single optical fiber cable.
2. Insertion loss not more than 0.75 dB.
3. Marked to indicate transmission performance.
4. Designed to snap-in to patch panel or faceplate.

2.4 SOURCE QUALITY CONTROL

A. Nonconforming Work:

1. Cables that do not pass tests and inspections will be considered defective.

B. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 SELECTION OF OPTICAL FIBER TYPE

A. Installed in Plenum, Duct, or Other Space Handling Environmental Air:

1. Nonconductive:

a. Type OFNP.

3.2 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

A. Optical fiber backbone cabling system must provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters may not be used as part of backbone cabling.

C. Comply with BICSI N1, NECA NEIS 1, and NECA NEIS 301.

D. Backbone cabling system must comply with transmission standards in TIA-568.1.

E. Telecommunications Pathways and Spaces: Comply with TIA-569.

F. Wiring Methods:

1. Not in Raceway: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
2. In Raceway: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

    a. Install plenum cable in environmental airspaces, including plenum ceilings.
    b. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."

3. In Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

G. Optical Fiber Cabling Installation:

1. Comply with TIA-568.1 and TIA-568.3.
2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."
3. Terminate all cables; no cable may contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inch and not more than 6 inch from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
6. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps may not be used for heating.
9. In communications equipment room, provide 10 ft long service loop on each end of cable.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
11. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

H. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Cable may not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

I. Group connecting hardware for cables into separate logical fields.

3.3 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569, Annex A, "Firestopping."

C. Comply with BICSI ITSIMM, "Firestopping" Chapter.

3.4 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

1. Administration Class: Class 2.
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Section 271523 "Communications Optical Fiber Horizontal Cabling" for cable and asset management software.

C. Cable Schedule: Install in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish electronic copy of final comprehensive schedules for Project.

D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

E. Cable and Wire Identification:

1. Label each cable within 4 inch of each termination and tap, where it is accessible in cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 ft.
4. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use different color for jacks and plugs of each service.

F. Labels must be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606, for the following:

1. Flexible vinyl or polyester that flexes as cables are bent.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect optical fiber jacket materials for qualified electrical testing laboratory certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA-568.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Optical Fiber Cable Tests:

    a. Test instruments must meet or exceed applicable requirements in TIA-568.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    b. Link End-to-End Attenuation Tests:

        1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in one direction in accordance with TIA-526-14, Method B, One Reference Jumper.
        2) Attenuation test results for backbone links must be less than 2.0 dB. Attenuation test results must be less than those calculated in accordance with equation in TIA-568.1.

B. Nonconforming Work:

1. Cables will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective cables and retest.

C. Collect, assemble, and submit test and inspection reports.

1. Data for each measurement must be documented.
2. Data for field quality-control report submittals must be printed in summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from instrument to computer, saved as text files, and printed and submitted.

END OF SECTION 27 13 23

SECTION 27 15 13 - COMMUNICATIONS COPPER HORIZONTAL CABLING

1.1 SUMMARY

A. Section Includes:
   1. Category 6 twisted pair cable.
   2. Twisted pair cable hardware.
   3. Cable management system.
   4. Identification products.

1.2 DEFINITIONS

A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. Jack: Also commonly called an "outlet," it is the fixed, female connector.

E. LAN: Local area network.

F. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.

G. RCDD: Registered Communications Distribution Designer.

H. UTP: Unscreened (unshielded) twisted pair.

1.3 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

   1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
   2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
   3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft. and includes the components that extend from the equipment outlets to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

1.4 ACTION SUBMITTALS

A. Product Data:
   1. Category 6 twisted pair cable.
   2. Twisted pair cable hardware.
   3. Cable management system.
   4. Identification products.

B. Shop Drawings: Reviewed and stamped by RCDD.

   1. System Labeling Schedules:

      a. Electronic copy of labeling schedules, in software and format selected by Owner.
      b. Electronic copy of labeling schedules that are part of cabling and asset identification system of software.

   2. Cabling administration Drawings and printouts.
   3. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:

      a. Telecommunications rooms plans and elevations.
      b. Telecommunications pathways.
      c. Telecommunications grounding system.
      d. Telecommunications conductor drop locations.
      e. Typical telecommunications details.

C. Twisted pair cable testing plan.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.

B. Product Certificates: For each type of product.

C. Source quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

   1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
   2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

   1. Test each pair of twisted pair cable for open and short circuits.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

C. Grounding: Comply with TIA-607-D.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:

1. Communications, Plenum Rated:

a. Type CMP complying with UL 1685.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

C. RoHS compliant.

2.3 CATEGORY 6 TWISTED PAIR CABLE

A. Category 6 Twisted Pair Cable: Four-pair, balanced -twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250 MHz.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Leviton.
b. Panduit Corp.
c. Superior Essex Inc.; subsidiary of LS Corp.

B. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.

C. Conductors: 100-ohm, 23 AWG solid copper.

D. Shielding/Screening: Unshielded twisted pairs (UTP).

E. Cable Rating: Plenum.

F. Jacket: Colored thermoplastic as noted on the drawings.

2.4 TWISTED PAIR CABLE HARDWARE

A. Twisted Pair Cable Hardware: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Berk-Tek.
b. Panduit Corp.
c. Superior Essex Inc.; subsidiary of LS Corp.

B. General Requirements for Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 6.
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

C. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer. Obtain twisted pair cable hardware from same manufacturer as twisted pair cable, from single source.

D. Connecting Blocks:
1. 110-style IDC for Category 6.
2. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.

E. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.

1. Features:

a. Universal T568A and T568B wiring labels.
b. Labeling areas adjacent to conductors.
Replaceable connectors.
c. 24 or 48 ports.

2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.

F. Patch Cords: Factory-made, four-pair cables in 48-inch lengths; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.

G. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Standard: Comply with TIA-568-C.2.
3. Marked to indicate transmission performance.

H. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or cover plate.
3. Standard: Comply with TIA-568-C.2.
4. Marked to indicate transmission performance.

I. Cover Plate:

1. Two and Four port, vertical single gang cover plates designed to mount to single gang wall boxes.
2. Plastic Cover Plate: High-impact plastic. Coordinate color with Section 260533.16 "Boxes and Covers for Electrical Systems."
3. Metal Cover Plate: Stainless steel, complying with requirements in Section 260533.16 "Boxes and Covers for Electrical Systems."
4. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.

    a. Flush mounting jacks, positioning the cord at a 45-degree angle.

J. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.5 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Routing:

1. Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, attics, and gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables, except in unfinished spaces.

    a. Install plenum cable in environmental air spaces, including plenum ceilings.
    b. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."

2. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF PATHWAYS

A. Comply with requirements for demarcation point, cabinets, and racks specified in Section 271100 "Communications Equipment Room Fittings."

B. Comply with Section 270528 "Pathways for Communications Systems."

C. Comply with Section 270529 "Hangers and Supports for Communications Systems."

D. Drawings indicate general arrangement of pathways and fittings.

3.3 INSTALLATION OF TWISTED PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. General Requirements for Cabling:

1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. Consolidation points may be used only for making a direct connection to equipment outlets:

    a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    b. Locate consolidation points for twisted pair cables at least 49 feet from communications equipment room.

7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
8. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
12. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
13. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Group connecting hardware for cables into separate logical fields.

E. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.5 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

C. Comply with TIA-607-D and NECA/BICSI-607.

D. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

E. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

1. Administration Class: Class 2.
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

D. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

E. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

B. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

C. Nonconforming Work:

1. End-to-end cabling will be considered defective if it does not pass tests and inspections.
2. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

D. Collect, assemble, and submit test and inspection reports.

END OF SECTION 27 15 13

SECTION 27 22 50 - VIDEO SURVEILLANCE SYSTEM WIRING

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Security Surveillance System

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Technology General Provisions

B. Cabling Systems Administration

C. Technology Pathway Hardware

D. Technology Firestopping

E. Structured Cabling System

1.3 SCOPE OF WORK

A. The term "Contractor" within this Specification section shall explicitly refer to the Technology Contractor.

B. The Technology Contractor shall install all cabling and related materials complete in strict accordance with Specifications and applicable Drawings as required for a Closed Circuit Television (CCTV) System. All cable shall be supplied by the Contractor.

C. All equipment necessary for proper operation of the system, not specified or described herein, shall be supplied and installed by the Owner's vendor. All associated installation hardware shall be supplied by the Technology Contractor.

D. The Electrical Contractor shall provide all conduit and backboxes and associated rough-in materials, with the exception of rough-in that is either integral to, or supplied with, the actual CCTV equipment. Coordinate exact requirements with the Technology Contractor and refer to the Technology Drawings for additional information.

E. The Owner's vendor shall provide all final terminations required to provide a completely operational CCTV system.

F. The EC and TC shall coordinate all efforts with the Engineer and Owner's CCTV vendor prior to commencement of work.

G. Any material and/or equipment necessary for the proper operation of the system not specified or described herein shall be deemed part of this Specification.

H. The complete installation shall conform to the requirements set forth by the NEC, all State and Local Building Codes, as required by the "Authority Having Jurisdiction" and the requirements of the Owner.

1.4 RECORD DRAWINGS

A. Record Drawings shall indicate exact equipment locations on floor plans (1/16" scale,

minimum). These drawings shall be dedicated solely to the Surveillance System and related wiring.

PART 2 - PRODUCTS

2.1 EQUIPMENT SOURCE

A. All end devices and processing equipment shall be provided by the Owner.

B. The Contractor shall provide for all receiving, unpacking and delivery of equipment as required by the Owner's vendor. The Contractor shall provide all labeling of cables that support the CCTV system. Refer to the Drawings for additional information. Coordinate exact cabling requirements with the Owner's CCTV Vendor.

C. The Contractor shall provide (1) category cable as called for in the faceplate details terminated in biscuit jack with 10' of service loop supported by j-hook and 3' patch cord. This applies for all indoor camera locations where the cable length shall not exceed 295' including the service loop. All camera network cabling shall be as called for in the specifications and be pulled to the telecommunications space serving the area of work.

D. For all building mounted exterior cameras - surge protection shall be provided at the device within the building.

E. Acceptable surge protection manufacturers:

1. ITW surgegate #cat6-LAN
2. Lcom ELP-CAT6
3. DITEK DTK-MRJPOEX

PART 3 - EXECUTION

3.1 INSTALLATION

A. All cabling shall be continuous from outlet to outlet without splices, with the exception of transitions for cable type and/or installation of lightning protection. Termination of cables shall be at equipment locations only. Install cable without sharp bends and terminate only with approved connectors. Underground may be installed in PVC conduit. Direct burial cable is not acceptable.

B. Contractor is responsible for mounting all exterior mounting brackets and devices (either pole mounted or mounted to the building). Brackets shall be by the surveillance vendor.

C. All outside components, i.e. power supply, surge suppressers, receiver drivers, shall be mounted in weatherproof boxes (NEMA 3R) with stainless steel or galvanized hardware.

D. Exterior units shall be mounted for optimum coverage and shall be protected from accidental contact and vandalism. Provide all required mounting hardware.

E. All low voltage cable shall be isolated from all line voltage equipment and wiring.

Provide a separate conduit system as required.

F. All installations shall be installed in a workmanlike manner.

G. Power supplies shall be mounted within manufacturer's recommended distances to prevent unwanted voltage drops.

H. All cables shall be identified with proper tagging and labels.

I. Refer to the Drawings for equipment quantities, locations, and installation details.

J. Contractor shall provide Record Drawings of complete system installation to Owner.

3.2 GUARANTEE AND WARRANTY

A. Contractor shall provide a one-year warranty on installation of all cabling and connections. Any defective material due to poor installation practice shall be replaced at no expense to the Owner (including labor). Cabling Warranty shall adhere to the structured cabling system warranty, typically 20 years.

B. The Contractor's guarantee shall cover all costs associated with the troubleshooting, repair, and replacement of defective work, including costs of labor, transportation, lodging, materials, and equipment.

3.3 RECORD DRAWINGS

A. Record Drawings shall indicate exact equipment locations on floor plans (1/16" scale, minimum). These drawings shall be dedicated solely to the Surveillance System and related wiring.

END OF SECTION 27 22 50

SECTION 28 40 00 - FIRE DETECTION AND ALARM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements for the installation, programming and configuration of a complete digital protocol analog addressable fire alarm system. This system shall include, but not be limited to, system cabinet, power supply, built in Signaling Line Circuit (SLC), 160 character LCD annunciator, four programmable notification circuits, built in dual line, IP and optional cellular digital communicator associated peripheral devices, batteries, wiring, conduit and other relevant components and accessories required to furnish a complete and operational life safety system.

B. Work Included: Contractor shall furnish and install a complete 24 VDC, electrically supervised, analog addressable fire alarm system as specified herein and indicated on the drawings. The system shall include but not be limited to all control panels, power supplies, initiating devices, audible and visual notification appliances, alarm devices, and all accessories required to provide a complete operating fire alarm system.

1.3 ACTION SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Include sufficient information, clearly presented, to determine compliance with the specifications and the Drawings.

C. Equipment Submittals:
   1. Cover Page: Indicate the following:
      a. Project name and address.
      b. Engineered systems distributor's name and other contact information.
      c. Installing contractor's name and other contact information.
      d. Date of equipment submittals. Indicate on revised submittals the original submittal date and revised submittal date.
   2. Table of Contents: Lists each section of equipment submittal.
   3. Scope of Work Narrative: Detail indented scope of work.
   4. Sequence of Operations: Use matrix or written text format, detailing activation of each type of device and associated resulting activation of the following:
      a. Control panel.
      b. Annunciator panels.
      c. Notification appliances.
      d. Building fire safety functions, including elevator recall, elevator power shutdown, door lock release, door holder release, HVAC unit shutdown, smoke evacuation system activation, and stair pressurization fan activation.
   5. Bill of Material: Indicate for each component of system the following:
      a. Quantity.
      b. Model number.
      c. Description.
   6. SLC Circuit Schedule: Detail address and associated description of each addressable device. Clearly provide information that indicates number of both active and spare addresses.
   7. Battery Calculations: Show load of each of, and total of, components of system along with standby and alarm times that calculations are based on. Show calculated spare capacity and size of intended battery.

D. Shop Drawings:
   1. Cover Page: Indicate the following:
      a. Project name and address.
      b. Engineered systems distributor's name and other contact information.
      c. Installing contractor's name and other contact information.
      d. Date of equipment submittals. Indicate on revised submittals the original submittal date and revised submittal date.
   2. Floor Plans:
      a. Provide separate floor plan for each floor.
      b. If a floor plan must be split using match lines to fit on the page, provide match lines and match line references that refer to sheet number that shows area on opposite side of match line.
      c. Prepare using AutoCAD.
      d. Prepare to scale 1/8 inch = 1'-0", unless otherwise required by the Architect or Engineer.
      e. Show equipment and device locations.
      f. Show wiring information in point-to-point format.
      g. Show conduit routing, if required by the AHJ.
   4. Control Panel: Provide sheet that details exterior and interior views of control panel and clearly shows associated wiring information.
   5. Annunciator Panels: Provide sheet that details exterior and interior views of annunciator panels and clearly shows associated wiring information.

E. Certification: Submit with equipment submittals and shop drawings, letter of certification from major equipment manufacturer, indicating proposed engineered system distributor is an authorized representative of major equipment manufacturer.

F. Project Record Drawings:
   1. Submit complete project record drawings within 14 calendar days after acceptance test.
   2. Project record drawings shall be similar to shop drawings, but revised to reflect changes made during construction.

G. Operation and Maintenance Manuals:
   1. Submit complete operation and maintenance manuals within 14 calendar days after acceptance test.
   2. Operation and maintenance manuals shall be similar to equipment submittals, but revised to reflect changes made during construction.

      3. Include factory's standard installation and operating instructions.

1.4 QUALITY ASSURANCE

A. All fire alarm system equipment shall be listed for its intended purpose and be compatibility listed to assure the integrity of the complete system.

B. The fire alarm equipment and installation shall comply with the current provisions of the following standards and shall be listed for its intended purpose and be compatibility listed to insure integrity of the complete system.

   1. National Electric Code, Article 760.
   2. National Fire Protection Association Standards.

      a. NFPA 70 National Electrical Code
      b. NFPA 72 National Fire Alarm Code
      c. NFPA 101 Life Safety Code
      d. NFPA 720 Standard for Installation of CO Detection

3. Local and State Building Codes
4. Local Authorities Having Jurisdiction
5. Americans with Disabilities Act (ADA).

    a. All visual Notification appliances and manual pull stations shall comply with the requirements of the Americans with Disabilities Act.

6. Underwriters Laboratories, Inc. (UL)

    a. All equipment shall be approved by Underwriters Laboratories, Inc. for it's intended purpose, listed as power limited by Underwriters Laboratories, Inc.
    b. UL 268 – Standard for Smoke Detectors for Fire Alarm Signaling Systems.
    c. UL 864 – Standard for Control Units and Accessories for Fire Alarm Systems.
    d. UL 1971 – Standard for Signaling Devices for the Hearing Impaired.
    e. UL 2572 – Standard for Control and Communication Units for Mass Notification Systems

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials from damage during handling and installation.

1.8 COORDINATION

A. Coordinate the Work of this section with the Work of other sections, including sprinkler systems, HVAC systems, and security/door locking systems as specified .

1.6 WARRANTY

A. Warranty Period for System Equipment: 3 year from date of final acceptance.

PART 2 - PRODUCTS

2.1 SYSTEM MANUFACTURER

A. Basis of Design System: Honeywell Farenhyt Series IFP-300

B. Acceptable Manufacturers: Honeywell Farenhyt is the Basis of Design of this specification and drawings. If one of the acceptable manufacturers below is accepted other than basis of design, any and all additional equipment shall be provided by the manufacturer in order to meet the intent of the drawings:

1. Gamewell FCI.
2. Notifier
3. Siemens

C. By using substitutions to Basis of Design Manufacturer, Contractor accepts responsibility and associated costs for all required modifications to related equipment and wiring.

D. This System Specification must be conformed to in its entirety to ensure that the installed and programmed Life Safety System will accommodate all of the requirements and operations required by the building owner. Any

specified item or operational feature not specifically addressed prior to the bid date will be required to be met without exception.

E. References to manufacturer's model numbers and other information are intended to establish minimum standards of performance, function, and quality

F. Submission of product purported to be equal to those specified herein will be considered as possible substitutes only when all of the following requirements have been met:

1. Any deviation from the equipment, operations, methods, design or other criteria specified herein must be submitted in detail to the Architect or Engineer prior to the scheduled submission of bids.
2. Each deviation from the operation detailed in these specifications must be documented in detail, including page number and section number, which lists the system function for which the substitution is being proposed.
3. A complete list of such substituted products shall be submitted to the approved Architect prior to the scheduled submission of bids.
4. The contractor or substitute bidder shall functionally demonstrate that the proposed substitute products are in fact equal in quality and performance to those specified herein.

2.2 GENERAL EQUIPMENT AND MATERIALS REQUIREMENTS

A. All equipment furnished for this project shall be new and unused. All components shall be designed for uninterrupted duty. All equipment, materials, accessories, devices and other facilities covered by this specification or noted on the contract drawings and installation specification shall be best suited for the intended use and shall be provided by a single manufacturer. If any of the equipment provided under this specification is provided by different manufacturers, then that equipment shall be "Listed" as to its compatibility by Underwriters Laboratories (UL), if such compatibility is required by UL standards.

2.3 CONTROL PANEL

A. The fire alarm control panel (FACP) shall be the Honeywell Farenhyt Series IFP-300 analog addressable fire alarm control panel. The FACP must have a 6 amp power supply and be capable of expansion to a minimum of 102 total amps via bus connected expander modules that supervise low battery, loss off AC and loss of communication.

B. The FACP must have Day/Night sensitivity capabilities on detectors and be capable of supporting up to 300 analog addressable points. This shall be accomplished via signaling line circuits (SLC) capable of supporting a minimum of 159 detectors and 159 module devices each. The main panel will contain one SLC circuit with the option of utilizing a 6815 expander module. The communication protocol on the SLC loop must be digital.

C. The FACP must be capable of being networked to create a virtual system that is larger than 300 addressable points. The FACP network must support up to 32 FACPs on the network providing a maximum addressable point capacity of 65,400 points (IFP-2100 capacity 2,100 x 31 = 65,100 + IFP-300 capacity 300 = 65,400).

D. The FACP must support a minimum of four programmable notification circuits. The panel must have a built in 160 character LCD annunciator with the capability of having an additional supervised remote annunciators connected in the field

E. The FACP must have a built in UL approved IP and digital communicator with the option of adding a cellular module for communications. The communicator must allow local and remote up/downloading of system operating options, event history, and detector sensitivity data.

F. The FACP must automatically test the smoke detectors in compliance with NFPA standards to ensure that they are within listed sensitivity parameters and be listed with Underwriters Laboratories for this purpose,

G. The FACP must compensate for the accumulation of contaminants that affect detector sensitivity. The FACP must have day/night sensitivity adjustments, maintenance alert feature (differentiated from trouble condition), detector sensitivity selection, auto-programming mode (Jumpstart) and the ability to upgrade the core operating software on site or over the telephone.

H. The FACP shall have a Jumpstart feature that can automatically enroll all properly connected accessories into a functional system. Panels that do not have these capabilities will not be accepted.

I. The main communication bus (S-BUS RS485) shall be capable of class A or class B configuration with a total Bus length of 6,000 feet.

2.4 WIRING

A. The Signaling Line Circuit (SLC) and Data Communication Bus (S-BUS) shall be wired with standard NEC 760 compliant wiring, no twisted, shielded or mid capacitance wiring is required for standard installations. All FACP screw terminals shall be capable of accepting 12-18 AWG wire. All system wiring shall be in accordance with the requirements of NFPA 70, the National Electrical Code (NEC) and also comply with article 760 of the NEC.

2.5 SIGNALIING LINE CIRCUITS

A. Each SLC shall be capable of a wiring distance of 5,000 feet from the SLC driver module (6815) and be capable of supporting 159 detectors and 159 addressable module devices. The communication protocol to SLC devices must be digital. Any SLC loop device, which goes into alarm, must interrupt the polling cycle for priority response from the FACP. The FACP must respond consistently to a device that goes into alarm on an SLC in under 10 seconds. The auxiliary 6815 SLC loop module must be capable of being located up to 6000 feet from the FACP on an RS-485 bus, which is separate from the SLC bus. The SLC shall be capable of functioning in a class A or class B configuration.

2.6 SLC LOOP DEVICES

A. Devices supported must include analog photoelectric, analog heat detectors, addressable input modules, relay output modules or addressable notification modules. There is to be no limit to the number of any particular device type up to the maximum of 159 detectors and 159 addressable modules that can be connected to the SLC.

2.7 ANALOG DETECTOR FUNCTIONS

A. The products of combustion detectors must communicate analog values using a digital protocol to the control panel for the following functions:

1. Automatic compliance with NFPA 72 standards for detector sensitivity testing
2. Drift compensation to assure detector is operating correctly
3. Maintenance alert when a detector nears the trouble condition
4. Trouble alert when a detector is out of tolerance
5. Alert control panel of analog values that indicate fire.

2.8 SENSITIVITY FUNCTIONS

A. The FACP shall have the ability to set three different sensitivity levels. A zone can be programmed to a day and a night sensitivity value. The day/night schedule shall allow for 16 holiday dates that are user programmable to allow the FACP to respond at the night level on those days.

2.9 PROGRAMABLE NOTIFICATION CIRCUITS

A. The FACP shall support four programmable notification circuits that are capable of being programmed as supervised reverse polarity notification circuits or supervised auxiliary power circuits that can be programmed as continuous, resettable, door holder power or sounder base synchronization. The circuits can be configured as four Class B outputs, two Class B and one Class A outputs or two Class A outputs.

2.10 ADDRESSABLE NOTIFICATION MODULE

A. The contractor shall furnish and install where indicated on the plans, addressable notification modules, Honeywell Farenhyt Series Model IDP-CONTROL or SK-CONTROL. The modules shall be U.L. listed compatible with Honeywell Farenhyt Series IFP-300ECS fire alarm control panel. The notification module must provide one class A (Style Z) or class B (Style Y) notification output with one auxiliary power input. The notification module must be suitable for mounting in a standard 4 square electrical box and must include a plastic cover plate. The notification module must provide an LED that is visible from the outside of the cover plate. The notification module must be fully programmable for such applications as required by the installation. The IDP-CONTROL or SK-CONTROL shall reside on the SLC loop and can be placed up to 5,000 feet from the control or 6815 SLC loop module.

2.11 ANNUNCIATORS

A. The main control must have a built in annunciator with a 160-character LCD display and feature LED's for Alarm, Supervisory, Trouble, Silenced and Power. When in the normal condition the LCD shall display time and date based on a 200 year clock which is capable of automatic daylight savings time adjustments. All controls and programming keys are silicone mechanical type with tactile and audible feedback. Keys have a travel of .040 in. No membrane style buttons will be permissible. The annunciator must be able to silence and reset alarms. The annunciators must have twenty levels of user codes that will allow the limitation of operating system programming to authorized individuals.

2.12 REMOTE ANNUNCIATORS

A. The fire system shall be capable of supporting remote annunciators. LCD Remote annunciator, Model RA-2000, shall have the same control and display layout so that they match identically the built in annunciator. Remote annunciators shall be available in two colors, red and light gray. Remote annunciators shall have the same functionality and operation as the built-in annunciator. All annunciators must have 160-character LCD displays and must feature five LED's for Alarm, Supervisory, Trouble, Silenced, and Power. All controls and programming keys are silicone mechanical type with tactical and audible feedback. Keys shall have a travel of .040 inches. No membrane style buttons will be permitted.

B. The annunciator must be able to silence and reset alarms. The annunciator must have twenty levels of user codes that will limit the operating system programming to authorized individuals. The control panel must allow all annunciators to accommodate multiple users input simultaneously. Remote annunciators shall be capable of operating at a distance of 6,000 feet from the main control panel on unshielded, non-twisted cable.

2.13 I/O LED DRIVER MODULE

A. The fire system shall be able to support a minimum of eight I/O modules (SK5880) that shall be used to drive remote LED graphic style displays and accommodate up to eight dry contact type switch inputs. The I/O modules shall each drive up to 40 LEDs without requiring external power connections. The I/O module inputs shall be

supervised and be suitable for alarm and trouble circuits as well as reset and silence switches. The system shall also support up to 40 LED drivers that reside on the two-wire SLC loop. These driver boards shall contain 80 LED outputs that are powered by an external power source.

2.14 SERIAL/PARALLEL INTERFACE

A. The fire system shall be capable of supporting up to two serial / parallel interfaces (SK5824) that are capable of driving standard computer style printers. The interface shall be programmable as to what information is sent to it and shall include the ability to print out Detector Status by point, Event History by point and System Programming.

2.15 DISTRIBUTED POWER MODULE

A. The contractor shall supply power modules, Models RPS-1000 and 5496, compatible with the IFP-300 fire alarm control panel. The RPS-1000 power module must have 6 amps of output power, six Flexput™ circuits rated at 3amps each, and two form C relay circuits rated at 2.5 amps at 24 volts DC. The six Flexput™ circuits shall be capable of being programmed as supervised reverse polarity notification circuits or supervised auxiliary power circuits that can be programmed as continuous, resettable or door holder power. The circuits shall also be programmable as input circuits in class A or B configurations to support dry contact or compatible two wire smoke detectors.

B. The RPS-1000 shall be capable of being connected via an RS-485 system bus (SBUS) at a maximum distance of 6,000 feet from the main control panel. The RPS-1000 shall contain an additional RS-485 bus that is completely compatible with all IFP-300 add on modules; including 6815 SLC expanders, RA-2000-SK5865-SK5880 annunciators, 5824 serial/parallel module and addressable devices. The RPS-1000 will also act as a bus repeater so that additional RS-485 (modules) devices can be connected at a maximum distance of 6,000 feet from the power module.

C. The 5496 power module must have 6 amps of output power and four circuits rated at 3 amps each. The four circuits can be programmed as notification outputs or auxiliary power outputs of door holder, constant and resettable types.

2.16 DIGITAL COMMUNICATOR

A. The digital/IP communicator must be an integral part of the control panel and be capable of reporting all zones or points of alarm, supervisory, and trouble as well as all system status information such as loss of AC, low battery, ground fault, loss of supervision to any remote devices with individual and distinct messages to a central station or remote station. The communicator must also be capable of up/downloading of all system programming options, event history and detector sensitivity compliance information to a PC on site or at a remote location.

B. The communicator shall transmit the information by one or more of the following means of communication – internet, cellular or standard telephone lines. The communicator must be capable of reporting via SIA and Contact ID formats. The communicator shall have a delayed AC loss report function which will provide a programmable report delay plus a 10-25 min random component to help ease traffic to the central station during a power outage. No controls that use external modems for remote programming and diagnostics shall be accepted.

2.17 DRY CONTACTS

A. The FACP will have three form "C" dry contacts, one will be dedicated to trouble conditions, the other two will be programmable for alarm, trouble, sprinkler supervisory, notification, pre-alarm, waterflow, manual pull, aux. 1 or aux. 2. The trouble contact shall be normal in an electrically energized state so that any total power loss (AC and Backup) will cause a trouble condition. In the event that the Microprocessor on the FACP fails the trouble contacts shall also indicate a trouble condition.

2.18 GROUND FAULT DETECTION

A. A ground fault detection circuit, to detect positive and negative grounds on all field wiring. The ground fault detector shall operate the general trouble devices as specified but shall not cause an alarm to be sounded. Ground fault will not interfere with the normal operation, such as alarm, or other trouble conditions.

2.19 OVER CURRENT PROTECTION

A. All low voltage circuits will be protected by microprocessor controlled power limiting or have a self restoring polyswitches for the following: smoke detector power, main power supply, indicating appliance circuits, battery standby power and auxiliary output.

2.20 TEST FUNCTIONS

A. A "Lamp Test" or "Indicator Test" mode shall be a standard feature of the fire alarm control panel and shall test all LED's and the LCD display on the main panel and remote annunciators.

B. A "Walk Test" mode shall be a standard feature of the fire alarm control panel. The walk test feature shall function so that each alarm input tested will operate the associated notification appliance for two seconds. The FACP will then automatically perform a reset and confirm normal device operation. The event memory shall contain the information on the point tested. the zone tripped, the zone restore and the individual points return to normal.

C. A "Fire Drill" mode shall allow the manual testing of the fire alarm system notification circuits. The "Fire Drill" shall be capable of being controlled at the main annunciator, remote annunciators and via a remote contact input.

D. A "Bypass Mode" shall allow for any point or NAC circuit to be bypassed without effecting the operation of the total fire system.

2.21 REMOTE INPUT CAPABILITIES

A. The control panel shall have provisions for supervised switch inputs for the purpose of Alarm reset and Alarm and trouble restore.

2.22 NOTIFICATION APPLIANCE MAPPING STRUCTURE

A. All notification circuits and modules shall be programmable via a mapping structure that allows for a maximum of 999 output groups. Each of these groups shall have the ability to be triggered by any of the panels 999 Zones. A zone may trigger from groups individually, or may contain a global trigger for manual pull stations, fire drills and two different system alarms. Additionally each Zone will individually control the cadence pattern of each of the Groups that it is "Mapped" to so that sounders can indicate a variety of conditions. The Zone shall be capable of issuing a different cadence pattern for each of the Groups under it's control. The mapping structure must also allow a group to be designated to "ignore cadence" for use with strobes and other continuous input devices. Zones shall have eight different output categories; Detector alarm, Trouble, Supervisory, Pre-alarm, Waterflow, Manual pull, Zone Auxiliary one and Zone Auxiliary two. The patterns are; March code, ANSI 3.41, Single Stroke Bell Temporal, California code, Zone 1 coded, Zone 2 coded, Zone 3 coded, Zone 4 coded, Zone 5 coded, Zone 6 coded, Zone 7 coded, Zone 8 coded, Custom output pattern 1, Custom output pattern 2, Custom output pattern 3, Custom output pattern 4, and Constant. Each NAC circuit can also be configured to produce one of four synchronization patterns: AMSECO synchronization, Gentex synchronization, System Sensor synchronization, and Wheelock synchronization. This mapping/cadence pattern shall be supported by all system power supplies and Notification Expander Modules. This mapping/cadence pattern shall be supported by all system power supplies and Notification Expander Modules.

2.23 DOWNLOADING SOFTWARE

A. The fire alarm control panel must support up/downloading of system programming from a Windows based PC. The FACP must also be able to download the detector sensitivity test results and a 1000 event system event buffer to the PC. Communication shall take place over a direct connection to the PC and/or via the same telephone lines as the built in digital communicator and shall not require an external modem to be connected to the panel. The downloading software shall contain a code that will block unauthorized persons from accessing the panel via direct connection or over the phone lines.

2.24 SYSTEM OPERATION

A. Alarm
   1. When a device indicates any alarm condition the control panel must respond within 10 seconds. The General Alarm or Supervisory Alarm LED on the annunciator(s) should light and the LCD should prompt the user as to the number of current events. The alarm information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators.
   2. When the alarmed device is restored to normal, the control panel shall be required to be manually reset to clear the alarm condition, except that the alarms may be silenced as programmed.
   3. An alarm shall be silenced by a code at the main or remote annunciators. When silenced, this shall not prevent the resounding of subsequent events if another event should occur (subsequent alarm feature). When alarms are silenced the silenced LED on the control panel, and on any remote annunciators shall remain lit, until the alarmed device is returned to normal

B. Troubles
   1. When a device indicates a trouble condition, the control panel System Trouble LED should light and the LCD should prompt the user as to the number of current events. The trouble information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators.
   2. When the device in trouble is restored to normal, the control panel shall be automatically reset, The trouble restore information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators. A trouble shall be silenced by a code or at the main or remote annunciators. When silenced, this shall not prevent the resounding of subsequent events if another event should occur.

C. Supervision methods
   1. Each SLC loop shall be electrically supervised for opens and ground faults in the circuit wiring, and shall be so arranged that a fault condition on any loop will not cause an alarm to sound. Additionally, every addressable device connected to the SLC will be supervised and individually identified if in a fault condition. The occurrence of any fault will light a trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition.
   2. Each indicating appliance circuit shall be electrically supervised for opens, grounds and short circuit faults, on the circuit wiring, and shall be so arranged that a fault condition on any indicating appliance circuit or group of circuits will not cause an alarm to sound. The occurrence of any fault will light the trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive fire alarm system.
   1. Notify Architect of conditions that would adversely affect installation or subsequent use.
   2. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

A. Install fire alarm system in accordance with NFPA 72, NFPA 70, state and local codes, manufacturer's instructions, and as indicated on the Drawings.

B. Conceal conduit, junction boxes, and conduit supports and hangers in finished areas. Conceal or expose conduit, junction boxes, and conduit supports and hangers in unfinished areas.

C. Do not install smoke detectors before system programming and test period. If construction is ongoing during this period, take measures to protect smoke detectors from contamination and physical damage.

D. Flush-mount fire detection and alarm system devices, control panels, and remote annunciators in finished areas. Flush-mount or surface-mount fire detection and alarm system devices, control panels, and remote annunciators in unfinished areas.

E. Ensure manual stations are suitable for surface mounting or semi-flush mounting as indicated on the Drawings. Install not less than 42 inches, nor more than 48 inches, above finished floor measured to operating handle.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide service of competent, factory-trained technician authorized by manufacturer to technically supervise and participate during pre-testing and acceptance testing of system.

B. Testing:
1. Conduct complete visual inspection of control panel connections and test wiring for short circuits, ground faults, continuity, and insulation before energizing cables and wires.
2. Close each sprinkler system control valve and verify proper supervisory alarm at INCC Command Center.
3. Verify activation of flow switches.
4. Open initiating device circuits and verify that trouble signal actuates.
5. Open signaling line circuits and verify that trouble signal actuates.
6. Open and short notification appliance circuits and verify that trouble signal actuates.
7. Ground initiating device circuits and verify response of trouble signals.
8. Ground signaling line circuits and verify response of trouble signals.
9. Ground notification appliance circuits and verify response of trouble signals.
10. Check alert tone and prerecorded voice message to alarm notification devices.
11. Check installation, supervision, and operation of intelligent smoke detectors.
12. Introduce on system each of the alarm conditions that system is required to detect. Verify proper receipt and proper processing of signal at INCC Command Center and correct activation of control points.
13. Consult manufacturer's manual to determine proper testing procedures when system is equipped with optional features. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality, and similar.

C. Acceptance Testing:
1. Before installation shall be considered completed and acceptable by AHJ, a complete test using as a minimum, the following scenarios shall be performed and witnessed by representative approved by Engineer. Monitoring company and/or fire department shall be notified before final test in accordance with local requirements.
2. Contractor's job foreman, in presence of representative of manufacturer, representative of Owner, and fire department shall operate every installed device to verify proper operation and correct annunciation at control panel.
3. Open signaling line circuits and notification appliance circuits in at least 2 locations to verify presence of supervision.
4. Completely disconnect INCC Command Center from rest of network, including Voice INCC Command Center. Activate initiating device from transponder. All speaker circuits activated from each transponder shall transmit the correct evacuation or alert message. These messages shall be same messages transmitted with INCC Command Center activated. Default tones or messages shall not be acceptable.
5. Completely disconnect INCC Command Center from rest of network. Activate initiating device. All control outputs supported by transponder SLC circuits shall operate under project programming mode. Default or degrade mode programming shall not be acceptable.
6. Fire fighter phone riser shall be directly shorted between INCC Command Center and first transponder, followed by test of fire phones between INCC Command Center and farthest transponder. Phones shall operate in normal fashion.

7. All audio risers shall be directly shorted between INCC Command Center and first audio transponder, followed by activation of alarm initiating device. Correct pre-recorded messages shall transmit from all speakers, including evacuation and alert channels. Default or degrade messages shall not be acceptable.
8. When testing has been completed to satisfaction of both Contractor's job foreman and representatives of manufacturer and Owner, a notarized letter co-signed by each attesting to satisfactory completion of said testing shall be forwarded to Owner and fire department.
9. Leave fire alarm system in proper working order and, without additional expense to Owner, replace defective materials and equipment provided within 1 year (365 days) from date of final acceptance by the owner.

3.4 DEMONSTRATION

A. Provide instruction as required for operating fire alarm system.

B. Provide hands-on demonstrations of operation of fire alarm system components and functions

END OF SECTION 28 40 00

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Temporary erosion- and sedimentation-control measures.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Contractor shall be the fully responsibility to become familiar with the site's possible below grade features, including but not limited to, rooms, vaults, utilities, etc. and shall conduct a walk through with the owner's representative prior to construction. Contractor shall contact the various utility companies to locate their facilities prior to starting construction. No additional compensation shall be paid to the contractor for repair to damage caused by their work force to facilities which are not intended to be disturbed.

C. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Construction Manager.

D. Salvable Improvements: Carefully remove items as directed to be salvaged and store on Owner's premises.

E. Utility Locator Service: Notify Call Before You Dig for area where Project is located before site clearing.

F. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

G. The project shall utilize a Certified Arborist from a reputable, experienced, third party independent tree service firm that has successfully completed temporary tree and plant protection and pruning work similar to the conditions present on this Project site.

H. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Erection of sheds or structures.
4. Impoundment of water.
5. Excavation or other digging unless otherwise indicated.
6. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Wrap a 1-inch blue vinyl tie tape flag around each tree trunk at 54 inches above the ground.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction

activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by the construction manager.

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Construction Manager not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Construction Managers' written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections and Section 02 41 16 "Structure Demolition".

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be

relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Do not stockpile topsoil within protection zones.
2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

C. Burning of materials shall not be permitted.

END OF SECTION 31 10 00

SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Geotechnical services has been performed by a qualified, experienced, third party, independent, licensed (in the state which the subject site resides), reputable geotechnical engineering testing firm. The site-specific Geotechnical Engineering Report takes precedence over specifications shown herein. Contractor shall become familiar with Geotechnical Engineering Report prior to earth moving activities. On-site testing during construction shall also be provided by a qualified, experienced, third party, independent, licensed (in the state which the subject site resides), reputable geotechnical engineering testing firm. The project owner retains the rights to omit or expand this geotechnical testing requirement.

C. The Local Jurisdiction having Authority's Specifications and requirements shall be adhered to and takes precedence over specifications shown herein for all work within the Jurisdiction's Rights of way, outside of the subject property's boundary.

1.2 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements, and turf and grasses, and plantings.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavements.
6. Subbase course and base course for asphalt paving.
7. Subsurface drainage backfill for walls and trenches.
8. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:

1. section 31 10 00 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Section 33 46 00 "Subdrainage" for drainage of foundations, underslab, retaining-wall, and landscaping.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving.

B. Quantity allowances for earth moving are to be assigned by the construction manager, owner, and/or architect at time of bidding.

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by construction manager. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Construction manager. Unauthorized excavation, as well as remedial work directed by Construction manager, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades, filling of holes, pits, and excavations.

H. Finish Grade: Elevation of final top surface improvement as indicated on drawings.

I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, or ripping, when permitted. Blasting is not permitted:

1. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,700 lbf (128 kN) and stick-crowd force of not less than 18,400 lbf (82 kN) with extra-long reach boom.
2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp (172-kW) flywheel power and developing a minimum of 47,992-lbf (213.3-kN) breakout force with a general-purpose bare bucket.

J. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

K. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

L. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

M. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

N. Unit price: An amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

O. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct pre-excavation conference at the subject project work area.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

a. Verify that survey benchmark(s) and intended elevations (lines, levels, contours, and datum locations) for the required improvements.
b. Personnel and equipment needed to make progress and avoid delays.
c. Coordination of Work with utility locator service.
d. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
e. Extent of trenching by hand or with air spade.
f. Field quality control.
g. Coordination of Access and Traffic Control.
h. Adjacent historic or vibration / sound sensitive buildings, properties, facilities, etc.
i. Other owner or local authority having jurisdiction specified agenda items specific to the site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Detectable Warning tapes.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

C. Seismic survey report from seismic survey agency for all historic areas and where sensitive features are present.

D. Pre-excavation Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.8 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

B. Source of Soil Materials Quality Control:
1. Where soil materials are to be supplied to the project site, testing and analysis of the material samples, from the actual source stockpile, is to be completed prior to delivery to the site.
2. If tests indicate materials do not meet specified requirements or the source stockpile from which the test material was taken no longer exists, a new and current material test from the actual stockpile to be used is to be completed for acceptance prior to delivery to the site.
3. Provide materials of each type from the same source of the approved test results throughout the course of construction or retesting of a new material source shall be provided prior to delivery to the site.

C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.9 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by the Construction Manager and/or the project owner.

C. Utility Locator Service: Notify the Local Utility Protection Service for area where Project is located before beginning earth moving operations. The contractor shall contract with a

private locator service for utilities onsite, which are not marked by the public service.

D. Do not commence earth moving operations until temporary erosion- and sedimentation- control measures, specified in 31 10 00 "Site Clearing," are in place.

E. Do not commence earth moving operations until plant-protection measures are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. Fill Composition Test Reports shall be provided to the project team with the results of laboratory tests on proposed and actual materials used on-site.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 and Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145 or a combination of these groups; free of lumps larger than 3 inches, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 and Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145 or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve; or Local DOT / Transportation Cabinet or CA-6 Federal Highway Specification. All materials shall have angular faces with no sandstone content.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-

inch sieve and not more than 12 percent passing a No. 200 sieve. Engineered Fill / Structural Fill shall be per site specific Geotechnical Engineering Report.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed, crushed stone, or crushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve. Free of shale, clay, friable material and debris.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch and 0 to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C 33; Natural river or bank sand; fine aggregate, free of silt, clay, loam, friable or soluble materials and organic matter. Well-graded Soil Classification Group SW according to ASTM D 2487.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 TOPSOIL

A. Topsoil: Fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds, and other litter or stones larger than 1 inch.
1. Minimum topsoil depth: 6-inches.
2. Stockpile existing topsoil on-site for reuse.

B. Any topsoil provided from off-site supplies shall be a silt loam soil with a pH of 5.5 to 7.0. Organic content shall be no less than 1% and no more than 12% by weight as determined by loss through ignition. The mechanical analysis shall be:

U.S. Standard Sieve Size	Percent Finer by Weight
3/4"	100%
No. 4	90 - 100%
No. 200	0 - 10%

The clay content of the material passing the No. 200 sieve shall not be greater than 60% determined by the hydrometer test.

C. Tests will be performed by the project's independent third-party laboratory on topsoil stockpile and off-site supplies.

D. The contractor shall coordinate with the construction manager for approval of all topsoil meeting the requirements above. The contractor shall ensure that the construction manager is onsite during any rockhounding operations for observation and approval.

2.3 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per

test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
4. Tear Strength: 90 lbf (400 N); ASTM D 4533.
5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.4 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150, Type I.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 36 to 42 lb/cu. ft. at point of placement, when tested according to ASTM C 138.
2. Compressive Strength: 140 psi, when tested according to ASTM C 495.

C. Produce conventional-weight, controlled low-strength material with 140-psi compressive strength when tested according to ASTM C 495.

2.5 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.

2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades. Determine the prevailing groundwater level prior to excavations.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area. Provide temporary measures to maintain surface water diversion(s) until no longer required.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

E. Pump discharge water will not be permitted to drain offsite or into the storm sewer system directly. All discharge water shall be directed to a sediment basin or run through a filter bag prior to release.

F. If soils with excessive moisture are present, due to the lack of dewatering or surface water control, the affected soils shall be removed and replaced with satisfactory soil materials deemed suitable by classification.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. Refer to Part 1.3 'Unit Prices' Item C. 'Rock Measurement' for dimension limits of removal.

B. Notify construction manager and/or architect of unexpected subsurface conditions immediately upon discovery and discontinue affected work until resolution is agreed upon.

C. Do not interfere with the 45-degree bearing splay of foundations.

D. Hand trim excavations as necessary to remove loose matter.

E. Remove excess and unsuitable materials from the site.

F. Slope and step banks of excavations deeper than 3 feet to the material's angle of repose or less to prevent any slippage. Provide all necessary shoring and safety measures in accordance with all laws and regulation.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
   2. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
   3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

   1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for additional bedding course.
5. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Protect and only cut roots according to the direction of the Project's Certified Arborist's.

3.8 SUBGRADE INSPECTION

A. Notify Construction Manager when excavations have reached required subgrade.

B. Compact subgrade to a density equal to or greater than the requirements for the subsequent fill material.

C. If Construction Manager determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

D. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Scarify subgrade surface to a depth of 6 inches to identify soft spots, recompact, and proof-roll.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by on-site geotechnical engineer and construction manager, and replace with compacted backfill or engineered fill as directed.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Construction Manager, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Construction Manager.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Construction Manager.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
2. Maintain separation of differing materials to prevent intermixing and contamination.
3. Protect stockpiles from erosion and deterioration of materials.

3.11 BACKFILL

A. Place and compact backfill to contours and elevations necessary using unfrozen satisfactory materials in excavations promptly and systematically to allow time for natural and mechanical settlement, but not before completing the following:

1. Compact subgrade to the density equal to or greater than requirements for subsequent fill material.
2. Until ready to backfill, maintain excavations and prevent loose materials from falling into excavation and do not become compromised with surface or ground water.
3. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
4. Surveying locations of underground utilities for Record Documents.
5. Testing and inspecting underground utilities, including underground tanks/vaults appropriately anchored to avoid flotation or shifting during and after backfilling.
6. Verify structural ability and stability of unsupported walls and other features to support imposed loads by filling and compaction.
7. Removing concrete formwork.
8. Removing trash and debris.
9. Removing temporary shoring and bracing, and sheeting.
10. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, wet, frost, snow, ice, porous, or spongy surfaces.

C. Placement of materials shall be done such that it does not disturb or damage other work.

D. Maintain optimum moisture content of fill materials to attain the required compaction density.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, wet, frost, snow, ice, porous, or spongy surfaces.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil material; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete".

D. Trenches under Roadways: All work shall be in accordance with the local Jurisdiction having Authority. After installing and testing, completely encase piping or conduit in a Low-Strength Mortar before placing roadway subbase course. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete".

E. Backfill voids with satisfactory soil material while removing shoring and bracing.

F. Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

H. Place and compact final backfill of satisfactory soil material to final subgrade elevation in maximum 8-inch lifts compacted to minimum 95 percent of maximum dry density according to ASTM D 1557 or to minimum 98 percent of maximum dry unit weight according to ASTM D 698.

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows under the direction of the geotechnical engineer:

1. Under grass and planted areas, use satisfactory soil material.

2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.
6. General fill, use graded soil material free of lumps lager than 3 inches, rocks larger than 2 inches, and debris conforming to ASTM D 2487 Group Symbol CL.
7. See Geotechnical Engineering Report for additional requirements.
8. Reshape and recompact fills subject to vehicular traffic.

C. Structural Fill:
1. Under the direction of construction manager and on-site geotechnical engineer to use engineered fill or subsoil excavated on-site material of graded, free of lumps larger than 3 inches, rocks larger than 2 inches, debris, waste, frozen materials, vegetation, and other deleterious matter confirming to ASTM D 2487 Group Symbol CL.
2. Maximum depth per lift: 6 inches, compacted to minimum 95 percent of maximum dry density according to ASTM D 1557 or to minimum 98 percent of maximum dry unit weight according to ASTM D 698.

D. Under Interior Slabs-On-Grade:
1. Use granular subbase material.
2. Maximum depth per lift: 4 inches, compacted to minimum 95 percent of maximum dry density according to ASTM D 1557 or to minimum 98 percent of maximum dry unit weight according to ASTM D 698.

E. At Footings:
1. Compact to minimum 95 percent of maximum dry density according to ASTM D 1557 or to minimum 98 percent of maximum dry unit weight according to ASTM D 698.
2. Do not backfill against unsupported foundation walls.

F. Granular Fill – Gravel: Pit run washed stone; free of shale, clay, friable material and debris graded in accordance with ASTM D 2487 Group Symbol GW.

G. Over Subdrainage Piping at Foundation Perimeter and Under Slabs:
1. Use drainage course material in conformance with Part 3.17 "Subsurface Drainage" of this specification and Section 33 41 00 "Subdrainage".

H. At Grass Lawn and Planting Areas:
1. Place and compact final backfill of satisfactory soil material to final subgrade elevation in maximum 8-inch lifts compacted to minimum 95 percent of maximum dry density according to ASTM D 1557 or to minimum 98 percent of maximum dry unit weight according to ASTM D 698.
2. See Part 2.2 "Topsoil" of these specifications.

I. Place soil fill on subgrades free of mud, wet, frost, snow, ice, porous, or spongy surfaces.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 1.5 percent above or 2.0 percent below of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, wet, frost, snow, ice, porous, or spongy surfaces.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 1.5 percent and is too wet to compact to specified dry unit weight.
3. Maintain optimum moisture content of fill materials to attain the required compaction

density.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in equal continuous layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers, and not more than 6 inches in depth for granular fill materials which shall be fully consolidated.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698, if not otherwise specified:

1. Under load-bearing foundation surfaces, structures, building slabs, and steps, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 100 percent.
2. Under pavements, walkways, and similar construction, scarify and recompact top 8 inches below subgrade and compact each layer of backfill or fill soil material at 98 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.

D. Placed backfill and fill soils within areas intended to have a soil profile restoration / areas to be naturalized / intended to be restore to good hydrologic conditions shall have the upper and deeper soil root zone(s) altered / amended in accordance with the local soil conservation authority's guidance requirements.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
3. Positive drainage shall be provided in all areas at all times. Do not allow water to pond on-site or block water along adjacent properties causing undue ponding.

B. Site Rough Grading: Slope grades to direct water away from buildings at minimum 2 inches in 10 feet (unless noted otherwise) and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1/2 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Section 33 46 00 "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 98 percent of maximum dry unit weight according to ASTM D 698.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 98 percent of maximum dry unit weight according to ASTM D 698.
2. Place and compact impervious fill over drainage backfill in 6-inch thick compacted layers to final subgrade.

3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase and base course and base course on subgrades free of mud, wet, frost, snow, ice, porous, or spongy surfaces.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. As directed, install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase and base course to required crown elevations and cross-slope grades.
4. Place subbase and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
5. Place subbase and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of base course material and compact simultaneously with each subbase and base layer to not less than 98 percent of maximum dry unit weight according to ASTM D698.

3.19 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, wet, frost, snow, ice, porous, or spongy surfaces.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. As directed, install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D698.

3.20 FIELD QUALITY CONTROL

A. Special Inspections: The project is to engage a qualified, experienced, third-party, independent, special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
4. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.
5. Testing inspector shall provide the project team and owner with written comprehensive reports with photographic documentation of the activities performed and the results of the observations and testing conducted.

B. Testing Agency: The project will engage a qualified, experienced, third party, independent, licensed (in the state which the subject site resides), reputable geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Construction Manager and/or Architect.

E. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 (“standard Proctor”), ASTM D 1557 (“modified Proctor”), or AASHTO T 180.

F. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

G. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to

depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by the Construction Manager; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property. Grade all areas for positive drainage and fully stabilize bare earth areas.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property as directed. Stockpile or spread soil as directed by Construction Manager and/or Owner.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

C. Leave all project, borrow, and utilized areas in a clean and neat condition.

END OF SECTION 31 20 00

SECTION 31 23 19

DEWATERING

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes construction dewatering.

B. Related Requirements:
1. Section 31 20 00 "Earthwork" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

1.3 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Using photograph or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized dewatering work.

B. Regulatory Requirements: Comply with water disposal requirements authorities having jurisdiction.

1.5 FIELD CONDITIONS

A. Project-Site Information: A geotechnical engineering report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.
1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
2. The geotechnical engineering report is included elsewhere in Project Manual.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
   1. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
   2. Prevent surface water from entering excavations by grading, dikes, or other means.
   3. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
   4. Remove dewatering system when no longer required for construction.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
   1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
   2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Protect and maintain temporary erosion and sedimentation controls during dewatering operations.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
   1. Space well points or wells at intervals required to provide sufficient dewatering.

2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.

C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 OPERATION

A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
3. Maintain piezometric water level a minimum of 24 inches (600 mm) below surface of excavation.

C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 FIELD QUALITY CONTROL

A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.
1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

C. Prepare reports of observations.

3.5 PROTECTION

A. Protect and maintain dewatering system during dewatering operations.

B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 31 23 19

SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The Local Jurisdiction having Authority's Specifications and requirements shall be adhered to and takes precedence over specifications shown herein for all work within the Jurisdiction's Rights of way, outside of the subject property's boundary.

1.2 SUMMARY

A. Section Includes:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt overlay.
3. Cold milling of existing asphalt pavement.
4. Hot-mix asphalt patching.
5. Asphalt surface treatments.
6. Pavement-marking paint.

B. Related Sections:

1. Section 024119 "Selective Demolition" for demolition and removal of existing asphalt pavement.
2. Section 31 20 00 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, aggregate pavement shoulder and subgrade preparation.
3. Section 32 13 73 "Concrete Paving Joint Sealant" for joint sealants and fillers at termination.
4. Section 32 13 13 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.

1.3 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 SUBMITTALS

A. All submittals shall be made to the construction manager and owner.

B. Product Data: For each type of product indicated within 10-days after being awarded the Project. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: Certified mix design indicating conformance with local DOT or Transportation Cabinet specifications and approvals which is not past the stated expiration date.

C. Samples of Material: Are to be provided to the Project's geotechnical engineer for the aggregates and asphalt binder which are to be used in the mix design.

D. Qualification Data: For qualified manufacturer and installer.

E. Material Certificates: For each paving material, from manufacturer.

F. Material Test and Field Quality-Control Reports: For each paving material.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the local DOT / Transportation Cabinet of the state in which Project is located.

B. Testing Agency Qualifications: Qualified in accordance with ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of local DOT / Transportation Cabinet for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

D. Materials supplied to the project site shall be obtained from the same source throughout construction.

E. Equipment: The necessary equipment to complete all work efforts shall be of good commercial quality which is appropriately sized for the work task being completed. All equipment shall meet the minimum standards and requirements of the local DOT / Transportation Cabinet specifications.

F. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
b. Review condition of subgrade and preparatory work.
c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
e. Review protocol to maintain consistent delivery and installation of hot materials to not form cold joint or seams where not intended.
f. Review inspection and testing requirements, governing regulations, and proposed construction procedures.

g. Review forecasted weather conditions and procedures for coping with inclement conditions.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacturer, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Shall be in accordance with the local DOT / Transportation Cabinet requirements; material product manufacturer's written instructions; and do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 50 deg F (15.6 deg C).
2. Tack Coat: Minimum surface temperature of 50 deg F (15.6 deg C).
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
4. Asphalt Base Course and Binder Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 degrees F for water-based materials, and not exceeding 95 degrees F.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound; clean angular crushed stone or angular crushed gravel; free of shale, clay, friable material and debris.

C. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, or combinations thereof; clean, free of shale, clay, friable material and debris.

1. For hot-mix asphalt, limit natural sand to a maximum of 10 percent by weight of the total aggregate mass.

D. Aggregate Gradation for use in Base Course Hot-Mix Asphalt:
1. Graded in accordance with ASTM C 136, with the following limits:
a. 2 inch sieve: 100 percent passing.
b. 1 inch sieve: 95 percent passing.

c. 3/4 inch sieve: 95 to 100 percent passing.
d. 5/8 inch sieve: 75 to 100 percent passing.
e. 3/8 inch sieve: 55 to 85 percent passing.
f. No. 4 sieve: 35 to 60 percent passing.
g. No. 16 sieve: 15 to 35 percent passing.
h. No. 40: 10 to 25 percent passing.
i. No. 200: 5 to 10 percent passing.

E. Aggregate Gradation for use in Surface Wearing Course Hot-Mix Asphalt:
1. Graded in accordance with ASTM C 136, with the following limits:
a. 2 inch sieve: 100 percent passing.
b. 1 inch sieve: 95 percent passing.
c. 3/4 inch sieve: 95 to 100 percent passing.
d. 5/8 inch sieve: 75 to 100 percent passing.
e. 3/8 inch sieve: 55 to 85 percent passing.
f. No. 4 sieve: 35 to 60 percent passing.
g. No. 16 sieve: 15 to 35 percent passing.
h. No. 40: 10 to 25 percent passing.
i. No. 200: 5 to 10 percent passing.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: Performance-Grade shall be utilized in accordance with local DOT / Transportation Cabinet Standard Specifications relative to the local pavement climate maps. PG binder shall in conformance with the requirements of AASHTO M 320, PG 64-22 and shall be adjusted for climate, location, traffic, reliability and RAP content.

B. Asphalt Cement: ASTM D 3381 for viscosity-graded material; ASTM D 946 penetration-graded at 25 °C (77 °F). If needed, volume corrections for asphalt binders shall be made according to ASTM D 4311. Asphalt Cement shall be in accordance with the local DOT / Transportation Cabinet Standard Specifications.

C. Prime Coat: ASTM D 2027, medium-curing cutback asphalt, MC-30 or MC-70 on close-textured surfaces; MC-250 on open-textured bases.

D. Emulsified Asphalt Prime Coat: Asphalt emulsion prime coat shall be in compliance with the local DOT / Transportation Cabinet and conform to ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

E. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, homogeneous, slow setting, diluted in water, of suitable grade and consistency for application.

F. Fog Seal: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

G. Water: Potable.

2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Base Course Only (excluded use in surface course):
   1. Reclaimed asphalt pavement (RAP) excludes reclaimed, unbound-aggregate base material.
   2. RAP shall consist of the material obtained from highways, streets, or asphalt parking lots by crushing, milling, or planing existing asphalt concrete pavements from sources and gradations that have performed satisfactorily in previous installations of an equivalent job-mix formula, equal to or better than performance of required hot-mix asphalt paving produced from all new materials, and in compliance with local DOT / Transportation Cabinet requirements.
   3. RAP shall not contain any proportion of recycled asphalt shingles (RAS).
   4. RAP shall be processed through an appropriate crusher of an asphalt concrete production facility yard so that the resulting material will contain no particles larger than the maximum aggregate size of the asphalt concrete mixture in which it will be used. The material shall have a reasonably uniform gradation from fine to coarse.
   5. The material source stockpile shall be free of excessive moisture, saturated conditions, and kept separate from virgin aggregates, dirt, vegetation, rubbish/debris, and not contaminated by foreign materials.
   6. RAP limits shall not exceed ODOT standard limits as specified in the ODOT CMS manual, Table 401.04-1 Method 1 Standard RAP/RAS limits
   7. ODOT RAP Method 2 is not permitted.

B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

C. Sand: ASTM D 1073 or AASHTO M 29, Grade Nos. 2 or 3.

D. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

E. Joint Sealant: ASTM D 6690, Type II or III, hot-applied (low modulus), single-component, polymer-modified bituminous sealant manufactured especially for improving strength and performance of the parent asphalt sealant.
   1. For material to be covered by an asphalt pavement overlay shall be low modulus conforming to ASTM D 6690, modified; refer to manufacturer’s recommendations.

F. Pavement marking paint: Refer to plans.

G. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

   1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.4 MIXES

A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction per local DOT / Transportation Cabinet specifications designed in accordance with procedures in AI MS-2, "Asphalt Mix Design Methods" and complying with the following requirements:

   1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

2. Use only dry materials to avoid foaming and other irregularities. Mix uniformly.
3. Base Course:
    a. Asphalt cement content shall be 4.0 to 6.0 percent by weight of mixture in accordance with AI MS-2.
    b. Mix shall have a nominal maximum particle size of ½-inch (12.5mm) or ¾-inch (19.0mm).
    c. Recycled asphalt pavement (RAP only) in the base course is limited to 35 percent maximum. No recycled asphalt shingles (RAS) in any asphalt mix will be permitted.
4. Surface Wearing Course:
    a. Asphalt cement content shall be 5.8 to 7.0 percent by weight of mixture in accordance with AI MS-2.
    b. Mix shall have a nominal maximum particle size of 3/8-inch (9.5mm).
    c. Mix shall have minimum of 80 percent passing the 3/8-inch (9.5mm) sieve. The aggregate grading curve shall be on the fine side of the maximum density line, unless otherwise required by the local DOT / Transportation Cabinet.
    d. No recycled asphalt material (RAP or RAS) in the surface course mix will be permitted.
5. Asphalt mixture properties shall meet the following minimum requirements; if conflict occurs with the local DOT / Transportation Cabinet requirements, the more restrictive shall take precedence:
    a. Coarse aggregate angularity ASTM D 5821: 75 percent of coarse aggregate portion shall have at least one fractured face.
    b. Fine aggregate angularity AASHTO T 304: 40 percent minimum.
    c. Flat and elongated pieces, 5:1 ratio ASTM D 4791: 10 percent maximum.
    d. Sand equivalency ASTM D 2419: 40 percent minimum.
    e. Natural sand content: 10 percent maximum.
    f. Air voids at OAC: 3.5 +/- 0.5 percent
    g. VMA based on the bulk dry specific gravity (Gsb):
        1) 3/8-inch (9.5mm) mixes: 15.0 percent.
        2) 1/2-inch (12.5mm) mixes: 14.0 percent.
        3) 3/4-inch (19.0mm) mixes: 13.0 percent.
    h. Dust proportion based on the effective binder content: 0.6 to 1.2.
6. When RAP is used in the base course mix design, the following requirements shall be adhered to:
    a. The gradation of the aggregate in the RAP shall be used in calculation of the mix gradation and fractured faces. Fine aggregate angularity, sand equivalent and flat and elongated particles shall not be measured for the RAP aggregate.
    b. The percentage of asphalt in the RAP shall be considered when determining the optimum asphalt content.
    c. Asphalt content of the total mixture for mix batching shall include virgin and reclaimed asphalt binder. The asphalt binder in the RAP shall be considered as part of the trial mix binder content.
    d. The specific gravity of the virgin binder shall be used as the specific gravity of the binder in the RAP for mixture design.
    e. The effective specific gravity of the aggregate in the TAP shall be determined and used as the bulk specific gravity of the RAP aggregate for calculation purposes.
    f. Use mixing and compaction temperatures for intended asphalt binder grade.

B. Emulsified-Asphalt Slurry: ASTM D3910
1. Use of Emulsified-Asphalt Slurry shall only be applied after being pre-approved by an informed owner of the finish product prior to use. Provide mockup application over a 5 ft. x 5 ft. area agreed upon with the owner.
2. Utilize Type 1 for surface sealing of lightly trafficked parking lot areas.

3. Utilize Type 2 for moderate traffic areas, filling minor surface voids, correction of surface erosion, and application of a minimal wearing surface.
4. Type 3 only to be utilized as directed for limited new wearing surface, low spot build-up, or managing skid resistance.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry, compacted, and in suitable condition to begin paving which are able to support the paving and imposed equipment loads.

B. Verify gradients and elevations of base are correct to maintain consistent asphalt layer thicknesses at no less than the intended minimum depths.

C. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

3.2 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the work.

B. Refer to Section 31 20 00 "Earth Moving" for subgrade inspection.

C. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Proofroll with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by on-site geotechnical engineer and construction manager, and replace with compacted backfill or engineered fill as directed.

D. Saw cut, using straight and true lines, all existing pavements, which do not have the necessary clean edges, to remain in place and abut against the new asphalt.

E. Proceed with paving only after unsatisfactory conditions have been corrected.

F. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections required for the proposed improvements.

1. Mill to the required depth for installation of the proposed improvements.

2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, driveway aprons, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Patch surface depressions deeper than 1 inch (25 mm) after milling, before wearing course is laid.
7. Handle milled asphalt material in accordance with approved waste management plan requirements in Section 01 74 19 "Construction Waste Management and Disposal."
8. Keep milled pavement surface free of loose material and dust.
9. Tight corners and areas with are not able to be reached with the primary milling machine shall have the equal depth of material removed either by hand work or other means. Remove unsound fractured full depth pieces when encountered and provide patch to affected area prior to mass placement of new materials.
10. Do not allow milled materials to accumulate on-site.

3.4 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Patching: Partially fill excavated pavements with hot-mix asphalt base course mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface wearing course layer finished flush with adjacent surfaces.

3.5 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Having a width or 1/8-inch or greater - Remove existing joint filler material, all vegetation, and debris from cracks or joints to a depth of minimum 5/8-inch and sterilize cleaned area.

1. Clean and prepare cracks and joints in existing hot-mix asphalt pavement in accordance with the joint material manufacturer’s recommendations.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Joint sealant to be filled to be 1/16-inch to 1/8-inch below the pavement surface with the sealant left slightly concave once cooled.
4. All preparation and applications of joint materials shall be in accordance with the

manufacturer's written instructions.

5. If sealant does not bond to the pavement sides of the repaired crack, sealant shall be removed, correct de-bonding problem and reinstalled new sealant.

3.6 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply to areas of previously known vegetation growth. Apply herbicide in accordance with manufacturer's recommended rates and written application instructions. Application surface is to be dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Herbicide may be mixed with prime coat if formulated by manufacturer for that purpose for project with a widely known vegetation issue.

C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (target application rate of 0.33 gal./sq.yd.). Apply enough material to penetrate and seal but not flood surface in accordance with manufacturer's instructions. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving. Traffic shall not be allowed over primed substrate.

D. Tack Coat: Apply uniformly to surfaces of pavement in accordance with the following:

1. Existing surfaces to receive the tack coat shall be thoroughly cleaned of all foreign matter and loose material and shall be dry before the tack coat is applied. Determination of adequate surface preparation shall be determined by the construction manager.
2. Tack coat shall be installed over all new and exiting concrete and asphalt pavements and structures prior to installation of new asphalt concrete material over said substrate.
3. Application shall be in accordance with manufacturer's instructions and completed with properly functioning tack distributor equipment, that has been calibrated with the last 12 months in accordance with ASTM D 2995, capable of maintaining temperature of material to ensure it will adequately flow and have the capability to develop sufficient pressure for force the material through the spray bar nozzles, creating a fan shape spray set at the proper height to provide an overlap on the ground with a minimum double lap.
4. Application Rates (gallons/sq.yd.) as follows:
   a. New Asphalt:
      1) Residual (straight tack) = 0.03 to 0.04
      2) Undiluted = 0.05 to 0.06
      3) Diluted (1:1) = 0.10 to 0.12
   b. Oxidized Asphalt:
      1) Residual (straight tack) = 0.05 to 0.06
      2) Undiluted = 0.08 to 0.09
      3) Diluted (1:1) = 0.15 to 0.18
   c. Milled Asphalt Surface:
      1) Residual (straight tack) = 0.05 to 0.06

2) Undiluted = 0.08 to 0.09
3) Diluted (1:1) = 0.15 to 0.18

d. Milled Concrete Surface:
1) Residual (straight tack) = 0.04 to 0.05
2) Undiluted = 0.06 to 0.08
3) Diluted (1:1) = 0.12 to 0.15

e. Portland Cement Concrete:
1) Residual (straight tack) = 0.04 to 0.05
2) Undiluted = 0.06 to 0.08
3) Diluted (1:1) = 0.12 to 0.15

f. Vertical Face, longitudinal construction joints shall be treated using a rate that will thoroughly coat the vertical face without excessive runoff.

5. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
6. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.7 INSTALLATION OF PAVING GEOTEXTILE

A. Apply geotextile manufacture's recommended type of tack coat or asphalt binder or asphalt cement uniformly to existing pavement surfaces at the geotextile's recommended application rate necessary to achieve maximum performance.

B. Place paving geotextile promptly in accordance with manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds under the direction of the manufacturer's instructions. Overlap longitudinal joints and transverse joints under the direction of the manufacturer's instructions.

C. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day / within the manufacturer's requirements.

3.8 HOT-MIX ASPHALT PLACEMENT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses necessary to be in compliance with the local DOT / Transportation Cabinet requirements.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 260 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Placement of material shall be paved in the direction of traffic unless otherwise directed by the construction manager or owner.
6. Placement of material shall be installed in accordance with all ADA and Universal Access requirements for accessible stalls, aisles, and pathways of travel.
7. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
8. Place hot-mix asphalt within 24 hours of applying prime or tack coat; surface shall be free of water.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips in a timely manner maintaining the proper temperature to extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface. Roll surface to fully consolidate after corrected irregularities.

D. The final finished grades of the new Hot Mix Asphalt Concrete pavements must be smooth and true to contours and shall be installed to the lines and grades of the site prior to the start of construction. The final finished grades shall match adjacent pavement surfaces and concrete slabs and aprons.

3.9 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method in accordance with AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations".
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.
7. Apply joint sealer to cold and dissimilar material joints.

3.10 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers. Do not displace or extrude pavement from position.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density, Marshall Test Method: 96 percent of reference laboratory density in accordance with ASTM D 6927 or AASHTO T 245, but not less than 94 percent nor greater than 100 percent.

2. Average Density, Rice Test Method: 94 percent of reference theoretical maximum density (TMD) in accordance with ASTM D 2041 or AASHTO T 209, but not less than 92 percent nor greater than 97 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement and protect from mechanical injury for 1 day or until it has cooled and hardened with a temperature less than 135 degrees F.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.11 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the required thickness within the following tolerances:

1. Base Course: Plus or minus 1/4 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Overall Variance from True Elevation: within ½ inch.

D. Asphalt Traffic-Calming Devices: Compact and form asphalt to the shapes intended and within a tolerance of plus or minus 1/8-inch of height intended above the pavement surface.

3.12 PAVEMENT MARKING

A. Refer to plans for product requirements.

B. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Construction Manager.

C. Apply pavement markings in two applications. The first application to be completed after placement of the final surface course, just prior to opening to traffic. Allow paving to age for 30 days before final pavement marking application.

D. Sweep and clean surface to eliminate loose material and dust.

E. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
   1. As directed, broadcast glass beads, in conformance with the local DOT / Transportation Cabinet, uniformly into wet pavement markings at a rate of 6 lb/gal.

F. Paint markings shall be provided for the required ADA/accessible areas and parking stalls. Contractor shall comply with the current local and federal rules, guidelines and codes for color, quantity, dimensions and associated.

3.13 SURFACE TREATMENTS

A. Fog Seals: As directed apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand (black beauty), lightly dust areas receiving excess fog seal.

B. Slurry Seals: As directed apply slurry coat in a uniform thickness in accordance with ASTM D3910 and allow to cure.
   1. Roll slurry seal where thickness exceeds ¼-inch to remove ridges and provide a uniform, smooth surface.

3.14 WHEEL STOPS

A. Install wheel stops in bed of adhesive as recommended by manufacturer.

B. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.15 FIELD QUALITY CONTROL

A. Refer to Section 01 40 00 "Quality Requirements", for general requirements of quality control.

B. Testing Agency: The project is to engage a qualified, experienced, third-party, independent, testing agency to perform tests and inspections in accordance with AI MS-2, unless otherwise specified.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined in accordance with ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances to not come in contact with the underside of the standard design vehicle per the local DOT / Transportation Cabinet specifications and owner's requirements.

F. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement in accordance with ASTM D 979 or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared in accordance with ASTM D 2041, and compacted in accordance with job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples in accordance with ASTM D 1188 or ASTM D 2726.

    a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three (3) cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method in accordance with ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

G. Replace and compact hot-mix asphalt where core tests were taken.

H. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.16 DISPOSAL

A. Except for material indicated to be recycled which are to be transported to the respective processing facility, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill or approved legal disposal location.

B. Do not allow milled materials to accumulate on-site.

C. General: Handle asphalt-paving waste in accordance with approved waste management plan required in Section 01 74 19 "Construction Waste Management and Disposal."

END OF SECTION 32 12 16

SECTION 32 13 13

CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Walk and curbed walk.
2. Pavement.
3. Curbs and gutters.
4. Exterior steps and ramps.

B. Related Sections:

1. Section 32 13 73 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving an in joints between concrete paving and asphalt paving or adjacent construction.

2. Section 31 20 00 "Earth Moving".

1.3 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; Current Edition.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; Current Edition

C. ACI 301 - Specifications for Structural Concrete; Current Edition.

D. ACI 302.1R - Guide to Concrete Floor and Slab Construction; Current Edition.

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; Current Edition.

F. ACI 305R - Guide to Hot Weather Concreting; Current Edition.

G. ACI 306R - Guide to Cold Weather Concreting; Current Edition.

H. ACI 308R - Guide to External Curing of Concrete; Current Edition.

I. ACI 330 – Specifications for Concrete Jointing, Current Edition.

J. ACI 330R – Guide for Design and Construction of Concrete Parking Lots, Current Edition.

K. ACI 330.2R – Site Paving for Industrial and Trucking Facilities, Current Edition.

L. ACI 347R - Guide to Formwork for Concrete; Current Edition.

M. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; Current Edition.

N. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; Current Edition.

O. ASTM C33/C33M - Standard Specification for Concrete Aggregates; Current Edition.

P. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; Current Edition.

Q. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; Current Edition.

R. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; Current Edition.

S. ASTM C150/C150M - Standard Specification for Portland Cement; Current Edition.

T. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; Current Edition.

U. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; Current Edition.

V. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; Current Edition.

W. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; Current Edition.

X. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; Current Edition.

Y. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; Current Edition.

Z. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; Current Edition.

AA. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; Current Edition.

BB. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); Current Edition.

CC. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; Current Edition.

DD. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water

Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; Current Edition.

EE. COE CRD-C 48 - Method of Test for Water Permeability of Concrete; Current Edition.

FF. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; Current Edition.

1.4 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and silica fume pozzolans.

B. W/C Ratio: The ratio by weight of water to cement.

C. W/Cm Ratio: The ratio by weight of water to cementitious materials.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

B. Other Action Submittals:
1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments which complies with the requirements of ACI 301 and 318.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Material Certificates: For the following, from manufacturer:
1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

C. Material Test Reports / Letter from Source Quarry: For the following:
1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity; verification of freeze/thaw and D-Cracking resistance for exterior pavements.

D. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.7 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A producer experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment that is registered with and approved by authorities having jurisdiction or the local DOT / Transportation Cabinet of the state in which Project is located.
   1. Manufacturer certified according to local DOT / Transportation Cabinet or NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. ACI Publications: Comply with ACI 301, 318 and respective ACI requirements.

C. Materials supplied to the project site shall be obtained from the same source throughout construction. If originating source becomes out of compliance, an alternative source meeting the same characteristics and requirements may be utilized only after notification has been provided to the owner/construction manager. The final appearance of alternative source materials shall be blended / transition where it would not be a noticeable change from original work.

D. The necessary equipment to complete all work efforts shall be of good commercial quality which is appropriately sized for the work task being completed. All equipment shall meet the minimum standards and requirements of the local DOT/Transportation Cabinet specifications.

E. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field-Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

F. Mockups: Build mockups as directed to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
   2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Construction Manager and not less than 96 inches by 96 inches.
   3. Acceptance of mockups does not constitute approval of deviations from the Contract Documents contained in mockups.

G. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to subject work including, but not limited to, the following:

      a. Review proposed sources of concrete materials, including capabilities and location of plant that will product the concrete.
      b. Review condition of subgrade and preparatory work.
      c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
      d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
      e. Review protocol to maintain consistent delivery and installation of materials to

not intentionally form cold joints where not intended.

f. Review inspection and testing requirements, governing regulations, and proposed construction procedures.

g. Review forecasted weather conditions and procedures for coping with inclement conditions.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Shall be in accordance with the local DOT / Transportation Cabinet requirements.

B. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

C. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 degrees F for water-based materials, and not exceeding 95 degrees F.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301.

2.2 FORMS MATERIALS

A. Form Materials: Conform to ACI 301.

1. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces, stain-free final concrete appearance with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
2. Form Coatings Release Agent: Provide commercial formulation form-coating compounds with a maximum VOC of 350 g/L that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from as-drawn steel wire into flat sheets.

B. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

C. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A, plain steel.

D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

E. Galvanized Reinforcing Bars: ASTM A767/A767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A615/A615M, Grade 60; deformed bars.

F. Epoxy-coated Reinforcement Bars: ASTM A 775/A 775M with ASTM A 615/A 615M, Grade 60; deformed bars.

G. Plain-Steel Wire: ASTM A 1064/A 1064M, galvanized.

H. Deformed-Steel Wire: ASTM A1064/A1064M.

I. Epoxy-Coated-Steel Wire: ASTM A884/A884M, Class A; coated, deformed.

J. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 555M, with ASTM A 615/A 615M, Grade 60 plain-steel bars. True to length with ends square and free of burrs.

K. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

L. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

M. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
   2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

N. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

O. Zinc Repair Material: ASTM A 780/A 780M.

P. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C 150, ordinary portland cement Type I or II. May be supplement with the following:

      a. Silica Fume: Shall be dry densified meeting the requirements of ASTM C 1240 and be in accordance with ACI 211.1.
      b. Fly Ash: Shall meet the requirements of ASTM C 618, Class C or F, except the loss on ignition must not exceed 5.0 percent and be in accordance with ACI 211.1.
      c. Slag Cement: Shall meet the requirements of ASTM C 989, Grade 100 minimum.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S (adjust for regional application), low-shrinkage, uniformly/well graded. Provide aggregates from a single source which are approved by the local DOT / Transportation Cabinet, or with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions

using similar aggregates and cementitious materials, or a letter from the source quarry documenting record of no alkali reactivity. Materials shall be resistant to freeze/thaw, D-Cracking, sulfate attack and are not alkali-carbonate aggregates or susceptible to alkali-aggregate reactivity.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: Potable and complying with ASTM C 94/C 94M. Clean, and not detrimental to concrete.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

E. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 1315, Type 2, Class A, dissipating, in accordance with ACI 308.

2.6 CONCRETE SEALER:

A. Manufacturer’s standard, clear, waterborne, penetrating, and breathable, silane-siloxane sealer shall be applied after curing period and per manufacture’s recommendations.

B. Other water-based silane-siloxane sealers applied per manufacturer's recommendations and approval at the discretion of the Construction Manager.

C. Concrete sealer shall be supplied with a written statement from the manufacture guaranteeing compatibility with the curing agent applied.

2.7 RELATED MATERIALS

A. Slab Isolation Joint Filler: 1/2 inch thick, height equal to full slab thickness contacting surface. Top section that is to be surface sealed shall form a 1/2 inch deep, or per joint sealant manufactures recommendations, sealant pocket.
   1. Material: ASTM D1751, Preformed, cellulose fiber non-extruding bituminous type or sponge rubber (ASTM D1752).

B. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.

C. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
   1. Types I and II for nonload bearing; Types IV and V for load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

2.8 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
   1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
   2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 Days): 4000 psi
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
   3. Slump Limit: 4 inches maximum without water reducer.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
   1. Air Content: 6.5 percent average plus or minus 1.5 percent (target content of 7.0 percent) for 1-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use plasticizing and retarding admixture in concrete as required for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials:
   1. Cementitious material content shall be per concrete mix design specifically tailored to the actual field conditions present at time of placement; design intent of 550 pounds per cubic yard.

2. Pozzolan Materials maximum content:
   a. Silica Fume may be used to replace portland cement, up to maximum 7.0 percent total cement weight.
   b. Fly Ash or Slag Cement may be used to replace portland cement, up to maximum 20.0 percent total cement weight.

G. Fibers: Use fibers according to manufacturer's written instructions. All fibers shall be polypropylene or polyethylene synthetic fibers engineered and designed for intended use, complying with ASTM C 1116/C 1116M, type III.
   1. For shrinkage crack control in all concrete used for curb, walk, exterior steps, ramps construction: Micro – synthetic fibers shall be utilized at 1.5 pounds per cubic yard minimum.
   2. For use as W.W.F. replacement in all concrete used for vehicular pavement construction: Macro – synthetic fibers 1.5 to 2.25 inches in length shall be utilized at 3.5 to 4.0 pounds per cubic yard, per manufacture's written instructions for equivalent W.W.F. replacement and in accordance with Modified ASTM C 1609.

H. Slag aggregates and steel slag aggregate: The use of slag aggregates and/or steel slag aggregate shall not be permitted in any concrete mix.

I. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer's written instructions.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

C. Do Not Add Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump. Utilize the appropriate admixture to achieve desired workability.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry, compacted, and in suitable condition to begin paving which are able to support the paving and imposed equipment loads.

B. Verify gradients and elevations of base are correct to maintain consistent material thicknesses at no less than the intended minimum depths.

C. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

3.2 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent materials from spilling, coating, or building up on surfaces adjacent to the work.

B. Refer to Section 31 20 00 "Earth Moving" for subgrade inspection.

C. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Proofroll with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by on-site geotechnical engineer and construction manager, and replace with compacted backfill or engineered fill as directed.

D. Saw cut, using straight and true lines, all existing pavements, which do not have the necessary clean edges, to remain in place and abut against the new concrete.

E. Proceed with paving only after unsatisfactory conditions have been corrected.

F. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork for grade and alignment prior to concrete material arriving to project site to following tolerances:

1. Top of forms not more than 1/8 inch in 10 feet.
2. Vertical face on longitudinal axis, nor more than 1/4 inch in 10 feet.
3. All ADA areas and pathways shall be confirmed to meet the current accessibility requirement including, but not limited to, not exceeding the maximum slopes, minimum dimensions, and respective perimeters. Areas and pathways shall have a zero tolerance for exceeding the maximum and minimum values.

C. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inchoverlap of adjacent mats.

3.5 JOINTS

A. General: All Joints shall conform to ACI 330 and comply with ACI 318-6.3, 6.4, ACI 301, Section 6 and the provisions of Section 32 13 73 Concrete Paving Joint Sealants.
   1. Provide/Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline. Joint angles less than 60 degrees shall not be permitted.
   2. When joining along existing concrete paving, place transverse joints to align with previously placed joints. Staggered/Offset or "T" intersecting joints, interior corners, angles less than 60 degrees, slabs less than 18-inches wide and odd shapes shall not be permitted.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation/expansion joints.
   1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
   2. Provide tie bars at sides of paving strips where indicated.
   3. Butt Joints: shall have a 20 percent, no less than 2.0-inch, thickened edges at end of panel and tapered over a minimum of 48-inches to normal section thickness for vehicular pavements. Use bonding agent/adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   4. Keyed Joints: Shall not be permitted.
   5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation (Expansion) Joints: Provide isolation joints of preformed joint-filler strips the full depth of the contacting surfaces which abutting other structures or fixed objects, and where indicated.
   1. Locate expansion joints in accordance with ACI 330.
   2. Extend joint fillers full width and full depth of joint.
   3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface in accordance with joint sealer manufacturer's requirements. Surface of joint shall be sealed.
   4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   5. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap or form. Remove protective top edge after concrete has been placed on both sides of joint, at the time when sealing the joint is to occur.

D. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

      a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut minimum width required (typically 1/8-inch-wide) for joint sealer material installation. Cut joints into concrete as soon as surface will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

      a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.
   3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Place all concrete in accordance with ACI 304R and ACI 304.2R.

B. Do not place concrete until base and forms have been checked for line and grade. Moisten base if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment. Provide box out collars around manholes, other structures, and structural columns, posts and similar.

C. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

D. Remove snow, ice, or frost and excess water from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces or on areas with ponding water, ensure positive drainage.

E. Placement of material shall be installed in accordance with all ADA and Universal Access requirements for accessible stalls, aisles, pathways of travel, and other related areas.

F. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete. Transport and placement of concrete shall not be more than 90 minutes after the water has been added to the dry ingredients at the batch plant.

G. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing or placing.

H. Use boding agent/adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

I. Deposit and spread concrete in a continuous operation between transverse joints. If interrupted for more than ½ hour, place a construction joint. Do not push or drag concrete into place or use vibrators to move concrete into place.

J. Place concrete using methods which prevent segregation of mix. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

K. Screed paving surface with a straightedge and strike off.

L. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

M. Curbs and Gutters: Produce curbs and gutters to required cross section, lines, grades, finish, and jointing. Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results that meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not which project specification, remove and replace with formed concrete as specified.

N. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
   1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

O. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306R and the following:

1. When the air temperature has fallen to or may be expected to fall below 40 degrees F, provide adequate means to maintain the temperature, in the area where concrete is being placed, at between 50 degrees F and 70 degrees F for at least 7 days after placing. Provide temporary housings or coverings including tarpaulins or plastic film. Maintain the heat and protection, if necessary, to ensure that the ambient temperature does not fall more than 30 degrees F in the 24 hours following the 7-day period. Avoid rapid dry-out of concrete due to overheating and avoid thermal shock due to sudden cooling or heating. If heaters are utilized, they shall be properly vented to direct exhaust gasses away from the curing concrete.
2. When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 55 degrees F and not more than 85 degrees F at point of placement.
3. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.
4. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, or set-control admixtures, unless approved by the Civil Engineer, in mix designs.
5. Do not apply de-icing chemicals to concrete less than 40 days old. This is due to a new recommendation by the Portland Cement Associations that for a durable finish concrete, the concrete should be giving a minimum 30-day drying period after moist curing if concrete is placed in the fall and will be exposed to freeze-thaw cycles and deicers when saturated.

P. Hot-Weather Placement: When hot weather conditions exist that would impair the quality and strength of concrete, place concrete in compliance with ACI 305R and as herein specified:
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 80 degrees F when the temperature is rising and below 85 degrees F when the temperature is falling. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated in the total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas before placing concrete.
4. Do not place concrete at a temperature so as to cause difficulty from loss of slump, flash set, or cold joints.
5. Do not use set-control admixtures unless pre-approved in mix designs.

3.7 FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. After striking-off and consolidating concrete, smooth surface by screening and floating. Use hand method only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

C. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared, and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

D. After floating, test surface for trueness with a 10-foot straightedge. Distribute concrete as required to remove surface irregularities and refloat repaired areas to provide a continuous smooth finish.

E. Work edges of slabs, and formed joints with an edging tool, and round to 1/2 inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

F. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
   1. Exterior slabs, sidewalks, flow channels, flumes, curbs, and other similar concrete pavement types shall have a non-slip finish by scoring the surface with a medium-hair broom, perpendicular to the line of traffic. Repeat operation if required to provide a texture acceptable to the Construction Manager.
   2. Retaining walls, wing walls, light pole bases, and other surfaces exposed to view upon completion of work shall be given a rubbed finish as specified below:
      a. Immediately upon removal of the forms, the surfaces to be rubbed shall be pointed up, thoroughly wetted and then rubbed with a No. 20 carborundum brick and water so as to produce a true, even, and smooth surface. When necessary to fill pinholes, and upon areas which have been reconstructed, rubbing shall be done by carborundum brick and a thin cement grout composed of 1 part of cement and 2 parts of fine washed silicone sand, all of which shall pass a No. 20 sieve. The surfaces finished with grout shall be carefully scraped with a steel edge so as to remove all surplus grout, after which it shall be given a final rub with a wood float until all skin and form marks shall be removed. No "wash" composed of cement and water, or cement, sand and water shall be used in this process.

G. BUFF WASH FINISH: Immediately after final troweling, spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
   1. At the contractors' discretion and without dislodging aggregate, remove mortar paste by either lightly brushing surface with a stiff, nylon-bristle broom while rinsing with water; or by using a power scrubber and water, or by using a power washer with the proper nozzle to minimize streaking the surface.
   2. Fine spray surface with water and brush if needed. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required and that the appearance of the finish concrete matches that of the approved samples.
   3. Surfaces shall have sandy-like appearance when completed.
   4. Finishes not noted to be 'standard' finish shall be very lightly broomed.
   5. Seal finished concrete only after curing period is over with a pre-approved concrete sealer product designed for intended application.

H. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Construction Manager.

3.8 CONCRETE PROTECTION, CURING, AND SEALING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot

temperatures.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture-retaining-cover curing, curing compound, or a combination of these in accordance with ACI 301 as follows:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
      d. Concrete which is moisture cured shall have a penetrating sealer, anti-spalling compound applied as specified.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
   3. Curing Compound: Apply first coat of two perpendicular uniformly applications in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period. A second coat of two perpendicular uniform applications in continuous operation by power spray or roller according to manufacturer’s written instructions to concrete surface no sooner than 28 days and no later than 40 days after placement, to clean, dry concrete free of oil, dirt, and other foreign materials.

E. Sealer, aAnti-Spalling Treatment: Penetrating Sealer (silane/siloxane), anti-spalling compound shall be applied over concrete. Apply compounds to concrete surfaces no sooner than 28 days after placement, to clean, dry concrete free of oil, dirt, and other foreign material. Apply penetrating sealer, anti-spalling compound in two sprayed applications. First application at rate of 40 square yards per gallon; second application, 60 square yards per gallon. Allow complete drying between applications.

F. All formed concrete work subject to lateral loading (retaining walls and similar) shall not receive such loads until 28 days of cure time unless approved by the concrete testing agency and construction manager.

3.9 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:
   1. Elevation: ADA Areas and Pathways – 1/8 inch. All other areas - 3/4 inch.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed 1/2 inch. ADA Areas and Pathways – Abrupt / unleveled vertical rises shall not exceed 1/4 inch in height. Horizontal gaps shall not exceed 1/2 inch in width.
   4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per

12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: The project is to engage a qualified, experienced, third-party, independent, testing agency to perform tests and inspections in accordance with ACI, unless otherwise specified.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
a. A compressive-strength test shall be the average compressive strength from two – 6x12 cylinders or three – 4x8 cylinders specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three-consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Construction Manager but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Construction Manager.

G. Concrete paving will be considered defective if it does not pass tests and inspections in accordance with ACI procedures for evaluating concrete. Investigation testing may be required to validate any suspect areas.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is cracked (which has not been placed/finished in accordance with ACI standards); broken, chipped; damaged; defective; or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by the Construction Manager.

B. Deficiencies that shall be considered defective work shall be:
1. Difference in elevation between panels of 1/4 inch or greater.
2. Cracks of any length that are 1/8 inch wide or wider.
3. Surface spalling covering in excess of 20% of the area of any 1 panel or 30% of the contiguous area of 2 or more adjacent panels.
4. A hole that is 1/2 inch or greater in depth and 2 inches or greater in diameter.
5. Residual splatter.
6. Pop-outs, blistering, dusting, delamination, crazing, mortar flaking, scaling, honeycombing.
7. Elevation difference of 1/4 inch in 10 feet caused by settling, that has not caused an elevation difference between panels.
8. Multiple hairline cracking within the same area.
9. Footprints, bike tire tracks, animal tracks, or the like, created while concrete was not cured.

C. Drill test cores, where directed by the Construction Manager, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

D. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

E. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

3.12 CLEAN-UP

A. For duration of work, Contractor is to maintain work area free of waste material, debris, and the like.

1. Contractor shall provide on-site containers as necessary for work of this Section. Locate as directed by Construction Manager.
2. Upon completion and when directed by Construction Manager, Contractor shall remove all excess material, debris, and equipment occasioned by the work.

END OF SECTION 32 13 13

SECTION 32 91 13

SOIL PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes planting soils and layered soil assemblies specified by composition of the mixes.

B. Related Requirements:

1. Section 32 92 00 "Turf and Grasses" for placing planting soil for turf and grasses.
2. Section 32 93 00 "Plants" for placing planting soil for plantings.

1.3 ALLOWANCES

A. Preconstruction testing is part of testing and inspecting allowance.

1.4 DEFINITIONS

A. AAPFCO: Association of American Plant Food Control Officials.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

C. CEC: Cation exchange capacity.

D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

F. Imported Soil: Soil that is transported to Project site for use.

G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

M. SSSA: Soil Science Society of America.

N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

Q. USCC: U.S. Composting Council.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for application and use.
2. Include test data substantiating that products comply with requirements.
3. Include sieve analyses for aggregate materials.
4. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:

    a. Manufacturer's qualified testing agency's certified analysis of standard products.
    b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
    c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Samples: For each bulk-supplied material, 1-quart volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.

B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

C. Field quality-control reports.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1. Multiple Laboratories: At Contractor's option, work may be divided among qualified testing laboratories specializing in physical testing, chemical testing, and fertility testing.

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil.

1. Notify Construction Manager seven days in advance of the dates and times when laboratory samples will be taken.

B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.10 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled under the direction of the testing agency.

1. Number and Location of Samples: Minimum of eight representative soil samples from varied locations for each soil to be used or amended for landscaping purposes.
2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.11 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

   a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
   b. Hydrometer Method: Report percentages of sand, silt, and clay.

2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).

C. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT NCR-13, including the following:

1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.
3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Sodium ppm.
14. Soluble-salts ppm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.

16. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. (100 sq. m) for 6-inch (150-mm) depth of soil.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. (100 sq. m) for 6-inch (150-mm) depth of soil.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Regional Materials: Imported soil, manufactured planting soil, and soil amendments and fertilizers shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

2.2 PLANTING SOILS SPECIFIED BY COMPOSITION

A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.

B. Planting-Soil Type: Imported, naturally formed soil from off-site sources and consisting of sandy loam, loam, silt loam,or loamy sand soil according to USDA textures; and modified to produce viable planting soil.

1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches (100 mm) deep, not from bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass.
2. Additional Properties of Imported Soil before Amending: Soil reaction of pH 6 to 7 and minimum of 4 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
3. Unacceptable Properties: Clean soil of the following:

    a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
    b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 8 percent by dry weight of the imported soil.
    c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inch (50 mm) in any dimension.

4. Amended Soil Composition: Blend imported, unamended soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:

    a. Ratio of Loose Compost to Soil: 1:4 by volume.

5. Additional Properties of Manufacturer's Basic Soil before Amending: Soil reaction of pH 6 to 7 and minimum of 4 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
6. Unacceptable Properties: Manufactured soil shall not contain the following:

    a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
    b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 5 percent by dry weight of the manufactured soil.
    c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inch (50 mm) in any dimension.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through a No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through a No. 60 (0.25-mm) sieve.
2. Class: O, with a minimum of 95 percent passing through a No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through a No. 60 (0.25-mm) sieve.
3. Form: Provide lime in form of ground mollusk shells.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through a No. 40 (0.425-mm) sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent

sulfur.

D. Perlite: Horticultural perlite, soil amendment grade.

E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 (0.30-mm) sieve.

F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:

1. Feedstock: May include sewage sludge and may include animal waste.
2. USCC reaction range requirement is pH of 5.0 to 8.5.
3. Reaction: pH of 5.5 to 8.
4. Soluble-Salt Concentration: Less than 4 dS/m.
5. Moisture Content: 35 to 55 percent by weight.
6. Organic-Matter Content: 30 to 40 percent of dry weight.
7. Particle Size: Minimum of 98 percent passing through a 4-inch (100-mm) sieve.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch (13-mm) sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture with 100 percent passing through a 1/2-inch (13-mm) sieve, a pH of 6 to 7.5, a soluble-salt content measured by electrical conductivity of maximum 5dS/m, having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.

D. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

1. Partially Decomposed Wood Derivatives: In lieu of shredded and composted wood derivatives, mix shredded and partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. (2.4 kg/cu.) of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. (4 kg/cu. m) of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.5 FERTILIZERS

A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. (0.5 kg/100 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

D. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

A. Excavation: Excavate soil from designated area(s) to a depth of 6 inches (150 mm) and stockpile until amended.

B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

C. Unsuitable Materials: Clean soil to contain a maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.

D. Screening: Pass unamended soil through a 1-inch (25-mm) sieve to remove large materials.

3.3 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Till subgrade to a minimum depth of 6 inches (150 mm). Remove stones larger than 2 inch (50 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 2 inches (50 mm) of subgrade. Spread remainder of planting soil.

C. Mixing: Spread unamended soil to total depth of 6 inches (150 mm), but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Amendments: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.

a. Mix fertilizer with planting soil no more than seven days before planting.

2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 12 inches (300 mm) in loose depth for material compacted by compaction equipment, and not more than 6 inches (150 mm) in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each blended lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698 and tested in-place.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 PLACING MANUFACTURED PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply manufactured soil on-site in its final, blended condition. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Till subgrade to a minimum depth of 4 inches (100 mm).

C. Remove stones larger than 2 inch (50 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply approximately half the thickness of planting soil over prepared, loosened subgrade. Mix thoroughly into top 2 inches (50 mm) of subgrade. Spread remainder of planting soil.

D. Application: Spread planting soil to total depth of 6 inches (150 mm) but not less than required to meet finish grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Lifts: Apply planting soil in lifts not exceeding 12 inches (300 mm) in loose depth for material compacted by compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

E. Compaction: Compact each lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698.

F. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.5 BLENDING PLANTING SOIL IN PLACE

A. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not

apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Preparation: Till unamended, existing soil in planting areas to a minimum depth of 4 inches (100 mm). Remove stones larger than 2 inch (50 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Mixing: Apply soil amendments, except compost, and fertilizer, if required, evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.

1. Mix fertilizer with planting soil no more than seven days before planting.

D. Compaction: Compact blended planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.6 APPLYING COMPOST TO SURFACE OF PLANTING SOIL

A. Application: Apply 4 inches (100 mm) of compost to surface of in-place planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Finish Grading: Grade surface to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 2000 sq. ft. (200 sq. m.) of in-place soil or part thereof.

C. Soil will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.8 PROTECTION

A. Protection Zone: Identify protection zones according to Section 01 56 39 "Temporary Tree and Plant Protection."

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Vehicle traffic.
4. Foot traffic.
5. Erection of sheds or structures.
6. Impoundment of water.
7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

3.9 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

1. Dispose of excess subsoil and unsuitable materials on-site where directed by Construction Manager or Owner.

END OF SECTION 32 91 13

SECTION 32 92 00

TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Seeding.
2. Hydroseeding.
3. Sodding.
4. Turf renovation.
5. Erosion-control material(s).

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 31 20 00 "Earth Moving" and drawing designations for planting topsoil.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
   1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

C. Product Certificates: For fertilizers, from manufacturer.

D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.

   1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
   2. Experience: Three years' experience in turf installation.
   3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the National Association of Landscape Professionals:

      a. Landscape Industry Certified Technician - Exterior.
      b. Landscape Industry Certified Lawncare Manager.
      c. Landscape Industry Certified Lawncare Technician.

   5. Pesticide Applicator: State licensed, commercial.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.9 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods and when soil temperatures are near 65 degrees. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Project completion.

1. Spring Planting: April 1st to May 31st.
2. Fall Planting: August 15th to October 15th.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED MIXTURES

A. Grass Seed: Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide seed mixtures and blends composed of grass species, proportions, and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified. All seed to be certified and have identification available for the Construction Manager to see.

B. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.

C. Seed species:

1. Quality, State Certified: State-certified seed of grass species as listed below for solar exposure.
2. Quality, for project area which do not have State Certified requirements: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:

D. Unless otherwise directed, Lawn Turf (Rate: 7-8lbs/1000 SF):

	PROPORTION BY WEIGHT	MINIMUM PURITY	MINIMUM GERMINATION
Lolium perenne, Var. "Manhattan 5" Perennial Ryegrass	20%	98%	90%
Festuca arundinacea, Var. "3rd Millenium" Tall Fescue	35%	98%	90%
Festuca arundinacea, Var. "Bullseye Tall Fescue	35%	98%	85%

Poa pratensis, Var. "Common" Kentucky Bluegrass	10%	95%	80%

E. Unless otherwise directed, Detention Seed Mix (5 lbs/ 1000 SF):

Festuca arundinacea var. KY 31 Kentucky 31 Fescue	40%	98%	90%
Poa pratensis varieties Kentucky Bluegrass	30%	98%	85%
Lolium perenna varieties Perennial Ryegrass	30%	98%	90%

F. Unless otherwise directed and shall in compliance with local Authority having Jurisdiction Temporary Seed Mix:

Lolium perenne, Var. Perennial Ryegrass	100%	95%	90%

2.2 TURFGRASS SOD

A. Turfgrass Sod: Certified, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

B. Turfgrass Species, Warm-Season Grass: Shall be in accordance with the regional varieties which have been proven to be successfully establish in a similar use.

C. Turfgrass Species, Cool-Season Grass: Unless otherwise directed, sod of grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:

1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
2. Sun and Partial Shade: Proportioned by weight as follows:

    a. 50 percent Kentucky bluegrass (Poa pratensis).
    b. 30 percent chewings red fescue (Festuca rubra variety).
    c. 10 percent perennial ryegrass (Lolium perenne).
    d. 10 percent redtop (Agrostis alba).

3. Shade: Proportioned by weight as follows:

    a. 50 percent chewings red fescue (Festuca rubra variety).
    b. 35 percent rough bluegrass (Poa trivialis).
    c. 15 percent redtop (Agrostis alba).

2.3 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of

fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

B. Post Emergent Herbicide with Fertilizer:

Acceptable Products

1. 20-3-3 with TRIMEC® Brand Herbicide & PCSCU
2. 15-0-8 + .86% Millenium SGN
3. 15-0-5 + 1.58% Viper

The rate of application to be used shall be based on results of laboratory tests conducted by the Contractor after final grading is completed.

2.4 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

C. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.

D. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
   1. Organic Matter Content: 50 to 60 percent of dry weight.
   2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

E. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

F. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

G. Asphalt Emulsion: ASTM D977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.5 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having

jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.6 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

C. Erosion-Control Mats: Cellular, nonbiodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 4-inch nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Construction Manager and replace with new planting soil.

3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF PREPARATION

A. General: Prepare planting area for soil placement and add amenities to topsoil as required for healthy lawn growth. Refer to Section 31 20 00 "Earth Moving" for topsoil requirements.

B. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain Construction Manager's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

C. Fill cells of erosion-control mat with planting soil and compact before planting.

D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING TURF

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed per section 2.1, this specification.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes that are 3:1 and exceeding 3:1 with erosion-control blankets installed and stapled according to manufacturer's written instructions, unless

otherwise directed.

E. Protect seeded areas with erosion-control mats where necessary and under the direction of the project's geotechnical engineer; install and anchor according to manufacturer's written instructions.

F. Protect seeded areas with slopes not exceeding 3:1 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

G. Protect seeded areas from hot, dry weather or drying winds by applying mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.6 HYDROSEEDING

A. Hydroseeding: Mix specified seed, commercial fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
3. Spray-apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

3.7 SODDING

A. Lay sod within 24 hours of harvesting, unless a suitable preservation method is accepted by Construction Manager and Owner prior to delivery time. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
1. Lay sod across slopes exceeding 3:1.
2. Anchor sod on slopes exceeding 6:1 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.8 TURF RENOVATION

A. All existing lawn not to be disturbed shall be renovated.

B. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

E. Mow, dethatch, core aerate, and rake existing turf.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).

I. Apply soil amendments and initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches (100 mm) of existing soil. Install new planting soil to fill low spots and meet finish grades.

1. Soil Amendment(s): According to requirements of the local conservation district.
2. Initial Fertilizer: Commercial fertilizer applied according to manufacturer's recommendations.

J. Apply seed and protect with straw mulch as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.

3.9 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting as necessary until the required maintenance period has expired and as much longer as necessary to establish a uniformly dense stand of specified grass and until accepted. And performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or

disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
3. Contractor shall be responsible for securing a water source for irrigating the lawn area until established. If an adequate water source is not available on site, the contractor shall truck in from an outside source at no additional cost to the owner.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow lawn and detention mix to a height of 3 inches to 3 1/2 inches.

D. After lawn areas are established, at least 6 weeks after seedling emergence, apply a post emergent herbicide and fertilizer to the turf on the entire property, including curb lawn. Herbicide shall be installed per manufacturer's specifications and based on site location and weather conditions.

E. Weeds not killed within a month of the post emergent application will be the responsibility of the contractor to remove to the engineer's satisfaction and without additional cost to the owner.

F. Apply Post Emergent Herbicide and Fertilizer to the turf on the entire property, including curb lawn, until the required maintenance period has expired. Apply in early May, late June and early September. Newly seeded areas which have received Type 1 fertilizer or areas that need reseeded shall not receive Post Emergent Herbicide and Fertilizer until the following scheduled application. Extend herbicide and fertilizer treatment to the following calendar year if unable to provide all herbicide and fertilizer applications.

G. All chemicals used must be mixed and applied according to manufacturer's specifications with consideration to site location and weather conditions.

H. This work must include furnishing experienced, qualified, and LICENSED personnel to perform spray operations.

3.10 SATISFACTORY TURF AREAS

A. Turf area installations shall meet the following criteria as determined by Construction Manager:

1. Satisfactory Seeded Areas: The contractor shall mow and maintain, including irrigation, fertilization, and weed control as required to establish a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities,

with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf and vegetation in detention areas that does not comply with requirements, and continue maintenance until the area is satisfactory.

3.11 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.12 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

3.13 MAINTENANCE SERVICE

A. Turf Area Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Maintenance" Articles. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn and Detention Area is established with a dense stand of specified plant material covering at least 95% of the area, but not for less than the following periods:

1. Seeded Turf/Detention Areas: 90 days after acceptance of a densely established lawn with 95% coverage and all bare spots have been repaired and established.

a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

b. Sodded Turf: 30 days from date of planting completion or Substantial Completion whichever is later.

END OF SECTION 32 92 00

SECTION 33 05 00

COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Sleeves.
4. Identification devices.
5. Grout.
6. Flowable fill.
7. Piped utility demolition.
8. Piping system common requirements.
9. Equipment installation common requirements.
10. Painting.

1.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

C. ABS: Acrylonitrile-butadiene-styrene plastic.

D. CPVC: Chlorinated polyvinyl chloride plastic.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 and Smaller:

1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 and Larger:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Cascade Waterworks Mfg. Co.
    b. Dresser, Inc.; DMD Div.
    c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
    d. JCM Industries.
    e. Smith-Blair, Inc.
    f. Viking Johnson.
2. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Spears Manufacturing Co.
2. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.

E. Plastic-to-Metal Transition Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Colonial Engineering, Inc.
    b. NIBCO INC.
    c. Spears Manufacturing Co.
2. Description: MSS SP-107, CPVC and PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Cascade Waterworks Mfg. Co.
    b. Fernco, Inc.
    c. Mission Rubber Company.
    d. Plastic Oddities.
2. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.3 SLEEVES

A. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

F. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.4 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.

1. Material: Fiberboard.
2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure- sensitive-vinyl type with permanent adhesive.

F. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

G. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

H. Lettering: Manufacturer's standard preprinted captions as selected by Architect.

I. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

K. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material: 0.032-inch-thick, aluminum.
2. Material: 0.0375-inch-thick stainless steel.
3. Material: 3/32-inch- thick plastic laminate with 2 black surfaces and a white inner layer.
4. Material: Valve manufacturer's standard solid plastic.
5. Size: 1-1/2 inches in diameter, unless otherwise indicated.
6. Shape: As indicated for each piping system.

L. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

M. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin- laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/8 inch, unless otherwise indicated.
3. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:

    a. Name and plan number.
    b. Equipment service.
    c. Design capacity.
    d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

1. Size: 3-1/4 by 5-5/8 inches.
2. Fasteners: Brass grommets and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped

utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

2.5 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.6 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C 150, Type I, portland.
2. Density: 115- to 145-lb/cu. ft.
3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
4. Aggregates: ASTM C 33, natural sand, fine.
5. Admixture: ASTM C 618, fly-ash mineral.
6. Water: Comply with ASTM C 94/C 94M.
7. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

a. PVC Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.5 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.6 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
3. Locate pipe markers on exposed piping according to the following:

a. Near each valve and control device.
b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
d. At manholes and similar access points that permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.8 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement.

3.9 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 33 05 00

SECTION 33 11 00

WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 WORK REQUIRED

A. Contractor shall furnish all material, equipment, tools and labor necessary to construct, flush, disinfect buried water pipe lines, fire hydrants, valves, pressure test buried water pipe lines, and connect to the existing water main as specified and shown on the drawings and as required by the Medina County. See Civil drawings for waterline connections.

1.3 QUALITY ASSURANCE

A. Each length of pipe as delivered to the site shall bear the manufacturer's stamped marking showing the size, class of pipe, and that it complies with the standard specifications referenced herein.

B. Comply with the referenced standards of the following organizations:
1. American National Standard Institute (ANSI); ANSI B 31.1 Power Piping.
2. American Society for Testing and Materials (ASTM).
3. American Water Works Association (AWWA).
4. Medina County Standard Construction Drawings and Specifications.
5. National Fire Protection Association (NFPA).
6. Ohio EPA

1.4 PROTECTION AND DISPOSITION OF UTILITIES

A. See Section 31 20 00 "Earth Moving".

1.5 SUBMITTALS

A. Product Data: For each type of material.

PART 2 - PRODUCTS

2.1 WATER MAINS AND FITTINGS – 4" DIAMETER AND LARGER

A. Water lines shall be per ODOT CMS Item 748, and as designated on the plans.

2.2 WATER MAINS AND FITTINGS – WELL DISCHARGE LINES

A. Well discharge piping shall be 3" SDR 17 HDPE with push on joints. All joints within (2) two full pipe lengths of any fitting or bend shall be restrained with retainer glands (no thrust blocks).

2.3 CONCRETE

A. ODOT Class QC 1.

2.4 BEDDING MATERIAL

A. ODOT approved materials as outlined in the trench detail on the project construction plans.

2.5 PREMIUM BACKFILL

A. ODOT 304 Limestone Aggregate Base.

2.6 HYDRANTS

A. Hydrants shall be per the Agency Having Jurisdiction Standards and Specifications.

B. Hydrants shall have one 4-1/2" pumper nozzle and two 2-1/2" hose nozzles.

C. Threads shall be per the Agency Having Jurisdiction Standards and Specifications..

PART 3 - EXECUTION

3.1 INSTALLATION METHODS

A. Precautions shall be taken to protect pipe interiors, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. When pipe-laying is not in progress, as, for example, at the close of the day's work, all openings in the pipeline shall be closed by watertight plugs. Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is completely dewatered.

B. Cutting of Pipe:
   1. The cutting of pipe for inserting valves, fittings, or closure pieces shall be done by machine cutting in a neat and skillful manner without damage to the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe.
   2. All burrs shall be ground off to leave a smooth joining surface. Only qualified and experienced workers shall do this work.

C. Bedding. Bedding shall be installed as detailed on plans.

D. Install to the lines and grades shown on the drawings. Maintain 60" minimum depth of cover to top of pipe outside of the building.

E. Where proposed waterlines cross proposed or existing sewers, provide a minimum vertical clearance of 18-inches between outside pipe edges of sanitary sewer and 12-inches minimum vertical clearance between storm sewers. Provide a 5-foot minimum horizontal clearance between the outside edge of the waterline and storm sewers. Provide a 10-foot minimum horizontal clearance between the outside edge of the waterline and sanitary sewers. Provide a 18-inch minimum vertical clearance and a minimum 5-foot horizontal clearance between waterline and gas, electric, cable and all other conduits.

3.2 TRENCHING AND BACKFILL

A. Refer to Division 31 20 00 – "Earth Moving".

3.3 PIPE, SPECIALS AND VALVES NOT SPECIFICALLY COVERED

A. Where indicated on the drawings, elsewhere specified, and as job conditions require, the Contractor shall provide in place all pipe, specials, valves and accessories of materials, classification, type and style not specifically covered by this section of the specifications. All said materials and work shall be in accordance with requirements of this specification, the latest requirements of Wayne County and shall provide complete approved installation. The Contractor shall obtain the Construction Manager's approval before ordering said materials.

3.4 ANCHORAGE FOR PLUGS, CAPS, TEES AND BENDS

A. General: All plugs, caps, tees, and bends, unless otherwise specified, shall be provided with reaction thrust blocking.

B. Thrust Blocking shall be Class QC 1 concrete. Backing shall be placed between solid ground and the fitting to be anchored shall, unless otherwise shown or directed, be so placed that the pipe and fitting joints will be accessible for repair.

3.5 PRESSURE TEST

A. Prior to acceptance, all waterlines shall be pressure tested in accordance with AWWA C-600. Pressure test shall be witnessed by the construction manager. Water, pumps, and accessories for filling and testing the lines shall be provided by the Contractor. Water shall be clean and potable.

3.6 FLUSHING AND DISINFECTION

A. After lines have been pressure tested, flush out each run of pipe thoroughly, to remove all foreign matter from the lines. Disinfect in accordance with AWWA C651. Provide copies of test results to the construction manager and owner. Water for flushing shall be clean, potable water. Water, pumps and accessories shall be provided by the Contractor.

3.7 RECORD DRAWINGS

A. The Contractor shall take actual field measurements of the water main during installation and shall furnish the Owner or his authorized agent with record prints of the same. This precludes the use of

the water service until disinfected, and the water pronounced fit for human consumption.

END OF SECTION 33 11 00

SECTION 33 30 00

SANITARY SEWERS

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 WORK REQUIRED

A. The work to be performed under this section consists of furnishing all labor, materials, utilities and equipment necessary to install gravity sanitary sewer and manholes from 5' outside the building, make connection to existing system and other related items as specified herein and as indicated on the contract drawings. See Architectural and Plumbing drawings for building sanitary sewer connections.

B. Upon completion, camera inspect all new or existing 4" and larger sanitary piping outside the building to the connection point.
   1. Notify Owner and Construction Manager of testing schedule in advance of testing.
   2. Clear any blockages in new piping, or attributable to new debris.
   3. Where applicable, notify Owner and Construction Manager of blockages in existing piping, or of any sections of existing piping that is collapsed or in poor condition.

1.3 REFERENCE SPECIFICATIONS

A. The following publications shall apply to this section when indicated.
   1. Ohio Department of Transportation (ODOT) Construction and Material Specifications, current edition.
   2. Ohio EPA

1.4 QUALITY ASSURANCE

A. Each length of pipe, as delivered to the site, shall bear the manufacturer's stamped markings showing the size, class of pipe, and that it complies with the standard specifications referenced herein.

B. Comply with the referenced standards of the following organizations:
   1. American Society of Testing and Materials (ASTM).

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. All work shall conform to regulations, codes, safety requirements, ordinances and law of federal, state, and local governing bodies having jurisdiction.

1.6 SUBMITTALS

A. Reports and tapes of tests performed.

B. Submit manufacturer's data sheets for piping materials and each type of product to be installed.

1.7 PROTECTION AND DISPOSITION OF UTILITIES

A. See Division 31 20 00 – "Earth Moving".

PART 2 - PRODUCTS

2.1 SEWER PIPE AND FITTING MATERIALS

A. Gravity Sewer PVC Pipe: PVC pipe conforming to ASTM D 3034, minimum wall thickness of SDR 26. Cell classification shall be 12454-B (ASTM D-1784). Joints shall be the bell and spigot type per ASTM 3212 with gaskets per ASTM F-477.

B. Where the sanitary lateral is less than 3 feet in depth, D.I.P. class 52 shall be used.

C. Transitional adapters are to be used from PVC to D.I.P. preferred single unit adapter is specified fittings 791056-CDD 6" or equal. Fernco fittings will not be permitted in place of adapters.

D. PVC sanitary sewer repairs shall be made using solid sleeve couplings only. Fernco fittings shall not be permitted for sanitary repairs.

2.2 SEWER BEDDING MATERIAL

A. See Division 31 – "Earth Moving". Slag, crushed concrete or other slacker aggregates are not permitted.

2.3 SEWER BACKFILL

A. Backfill for sewers under pavement (including sidewalk) or structures shall use premium backfill consisting of granular material per Division 31 "Earth Moving". Backfill for sewers in other areas may be ordinary backfill. No frozen material of any kind is permitted.

2.4 SEWER PERFORMANCE REQUIREMENTS

A. Gravity Flow, Non-pressure Piping Pressure Ratings: At least equal to system test pressure.

PART 3 - EXECUTION

3.1 TRENCHING AND BEDDING

A. Sewer installations shall not begin until subgrade is established within 6" of finished grades.

B. Trenching shall be accomplished as specified in Division 31 - "Earth Moving". Bedding material shall be placed and spread in 6" lifts. The material shall be placed from 6" below the bottom of the pipe to 12" above the top of the pipe. Before placing the bedding material, entire bedding surface shall be checked to assure firm and uniform bearing.

3.2 INSTALLATION OF PIPE

A. The pipe shall be installed to the lines and grades as established on the contract drawings. The trench shall be dewatered and kept dry during the pipe laying operations.

B. Where sanitary sewers cross waterlines at a clearance of less than 18 inches between pipe edges, the lower pipe shall be encased and the upper pipe monolithically cradled in 2500 PSI concrete.

3.3 MANHOLES

A. Manholes shall be installed to lines, grades and elevations as established on the drawings. Materials shall be per ASTM C 478 with joints per ASTM C 433.

B. The first precast section shall be placed on the cast-in place base before the base has taken initial set, and shall be carefully adjusted to true grade and alignment with all inlet pipes properly installed so as to form an integral watertight unit; or the section shall be mortared into a suitable groove provided in the top of the precast base. The first section shall be uniformly supported by the base concrete, and shall not bear directly on any of the pipes.

C. Precast sections shall be placed and aligned to provide vertical sides and vertical alignment of the ladder rungs. The completed manhole shall be rigid and true to dimensions.

D. All lift holes and all joints between precast elements shall be thoroughly wetted and then be completely filled with mortar, smoothed and painted both inside and out with bitumastic material to insure water tightness.

E. The pipe for the inlet and outlet connections shall extend through the wall and beyond the outside surface of the wall of sufficient distance to allow for connections.

F. The flow channel shall be constructed of sewer pipe set in concrete, or approved equal. Channels shall be semi-circular or U-shaped the spring line conforming to the inside diameter of the connection sewer. Where necessary, make gradual changes in size, grade or direction with true curves. No bricks shall be allowed in constructing flow channels.

G. Castings placed on concrete or masonry surface shall be set in full mortar beds. Casting shall be set accurately to the finished elevation so that no adjustment will be necessary.

H. A maximum 12” adjustment of grade is permitted with grade rings. Within the 12-inches, one layer of red paving brick may be used.

3.4 FINAL CONNECTION

A. Contractor shall install the sewer line to the lines and grades shown on the drawings. Installation shall meet the approval of the Ohio EPA.

3.5 BACKFILL

A. Install backfill and compact as per ODOT Item 611.06, except that the contractor shall provide granular material in trenches located under proposed pavement, sidewalk, curb, gutter, foundation, driveway, or parking area and as further described on the construction drawings.

3.6 TESTS

A. Upon completion and before the final tie-in, the entire gravity system shall be subjected to a low pressure air test per ASTM F1417. All test reports shall be submitted to the Architect and the Wooster Sanitary Department for review.

B. All gravity sewers shall be subjected to a pipe deflection test. The test shall not occur until at least 60 days after the soil/pipe system has been installed. The test shall consist of a hand pulling a mandrel device through the sewer. The mandrel shall be ither a full circle or 9-arm type which has outside dimensions which are 95% of the I.D. of the pipe being tested. Pipe failing the mandrel test shall be replaced at no cost to the owner or engineer (including excavation, site restoration, re-testing, etc).

C. Manholes shall be vacuum tested per ASTM C1244.

D. The tests shall be performed in presence of the construction manager and/or the Wooster Sanitary Department. The final acceptance of the system shall be subject to approval by the Architect, and The Wooster Sanitary Department. Sections of sewers that fail tests shall be repaired and retested to the satisfactory of the Architect and the Wooster Sanitary Department.

E. The Contractor is responsible for all costs associated with the specified testing. All tests shall be conducted by an independent, qualified laboratory chosen by the Contractor and approved by the Architect and the Wooster Sanitary Department as required.

F. The Wooster Sanitary Department shall make the final determination as to the acceptability of the sewer, based on the above test results.

3.7 CONNECTION TO BUILDING SERVICE LATERALS

A. Coordinate location of lateral connections to the building's sanitary sewer service with the building Plumbing Contractor. Final location of laterals is subject to the approval of the Architect and The Wooster Sanitary Department.

3.8 RECORD DRAWINGS

A. The Contractor shall take actual field measurements of the sanitary sewers and provide the Construction Manager with record prints of the same. Record drawings shall be made of the site utility plan. Provide sets of record drawings for the Wooster Sanitary Department as required, plus those required by the Architect.

END OF SECTION 33 30 00

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Nonpressure transition couplings.
3. Cleanouts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of any proposed interruption of service.
2. Do not proceed with interruption of service without written permission.

PART 2 - PRODUCTS

2.1 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
2. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.

B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
2. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.2 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.3 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.

1. Bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets.
2. Per ODOT 706.02.

2.4 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Concrete Pipes: ASTM C 443, rubber.
2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
3. For Fiberglass Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
4. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
5. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Dallas Specialty & Mfg. Co.
   b. Fernco Inc.
   c. Logan Clay Pipe.
   d. Mission Rubber Company; a division of MCP Industries, Inc.
   e. NDS Inc.
   f. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

2. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cascade Waterworks Mfg.
   b. Dallas Specialty & Mfg. Co.
   c. Mission Rubber Company; a division of MCP Industries, Inc.

2. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Fernco Inc.
   b. Logan Clay Pipe.
   c. Mission Rubber Company; a division of MCP Industries, Inc.

2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.5 CLEANOUTS

A. Plastic Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Canplas LLC.
   b. IPS Corporation.
   c. NDS Inc.
   d. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
   e. Sioux Chief Manufacturing Company, Inc.
   f. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group.

2.6 Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.7 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel or limestone.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

   a. Invert Slope: 1 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

   a. Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.8 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, with ASTM C-433 joints meeting the requirements of ODOT Item 706.13, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 8-inch minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 5-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and

top of cone of size that matches grade rings.

7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Reinforced propylene plastic according to ODOT 711.31
10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.
11. Manholes shall be constructed to support HS-20 highway loading.
12. Covers shall be heavy duty and be bolted or lockable to prevent tampering.
    a. Cover shall have "STORM" as applicable cast into the surface.

2.9 CATCH BASINS

A. Standard Precast Concrete Catch Basins:
   1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   2. Catch basins in or adjacent to pavement shall be constructed to support HS-20 highway loading.
   3. Base Section: 6-inch minimum thickness for floor slab and 8-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
   4. Joint Sealant: ASTM C 990 bitumen or butyl rubber.
   5. Grade Rings: Grade rings shall be precast concrete.
   6. Steps shall be reinforced propylene plastic according to ODOT Item 711.31
   7. Pipe Connectors: ASTM C 923 resilient, of size required, for each pipe connecting to base section.
   8. Frames and Grates: Shall be of the sizes and types referenced and/or shown on the drawings, and shall conform to ODOT Item 711.12
      a. Covers shall all be ADA compliant and heavy duty.

2.10 YARD DRAIN

A. Standard yard drains:
   1. Description: Yard drains shall be of the sizes and types referenced and/or shown on the drawings or an approved equal.
   2. Yard drains in or adjacent to pavement shall be constructed to support HS-20 highway loading.
   3. Frames and Grates: Shall be of the sizes and types referenced and/or shown on the drawings.
      a. Covers shall all be ADA compliant and heavy duty.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping with 36-inch minimum cover.
3. Install PE corrugated sewer piping according to ASTM D 2321.
4. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
2. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
3. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.5 CONNECTIONS

A. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

    a. Shielded flexible couplings for same or minor difference OD pipes.
    b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.6 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone or gravel. Fill to top with concrete.

C. Backfill to grade according to Section 31 20 00 "Earth Moving."

3.7 IDENTIFICATION

A. Materials and their installation are specified in Section 31 20 00 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
    b. Option: Test plastic piping according to ASTM F 1417.
    c. Option: Test concrete piping according to ASTM C 924.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.9 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION 33 41 00