

Project Manual

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CITY OF DAYTON CENTRAL WATER QUALITY LAB EXPANSION

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PROJECT NUMBER: 4165.00

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CITY OF DAYTON CMS MODIFICATIONS FOR ONLINE BIDDING

The City of Dayton Construction and Material Specifications are hereby modified by this Contract as follows:

100 GENERAL PROVISIONS

ITEM 101 ABBREVIATIONS

101 Abbreviations. The following abbreviations, when used in the Contract Documents, shall have the respective meaning shown below:

ANLA	American Nursery and Landscape Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
APWA	American Public Works Association
AREA	American Railway Engineering Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
AWG	American Wire Gauge
AWP	American Wood Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
CMS	Construction and Material Specifications of the Ohio Department of Transportation
DCE	District Construction Engineer
DDD	District Deputy Director
DET	District Engineer of Tests
DMA	Declaration Regarding Material Assistance/Non-Assistance to a Terrorist Organization
DNR	Department of Natural Resources
EEI	Edison Electric Institute
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration, Department of Transportation
FSS	Federal Specifications and Standards, General Services Administration
HRC	The Human Relations Council of the City of Dayton
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IMSA	International Municipal Signal Association
IPCEA	Insulated Power Cable Engineers Association
ISSA	International Slurry Seal Association
ITE	Institute of Transportation Engineers
JMF	Job Mix Formula
MSDS	Material Safety Data Sheet(s)

NCHRP	National Cooperative Highway Research Program
NEMA	National Electrical Manufacturers Association
NISTN	National Institute of Standards and Technology
NPDES	National Pollutant Discharge Elimination System
OAC	Ohio Administrative Code
ODOT	Ohio Department of Transportation
OMUTCD	Ohio Manual of Uniform Traffic Control Devices
ORC	Ohio Revised Code
ORDC	Ohio Rail Development Commission
OSHA	Occupational Safety and Health Administration
PCC	Portland Cement Concrete
RCGO	City of Dayton Revised Code of General Ordinances
REA	Rural Electrification Administration
SSP	Steel Structures Painting Council
STAR	State Treasurer's Asset Reserve
UL	Underwriters' Laboratories, Inc.

ITEM 102 DEFINITIONS

102 Definitions. The following words or terms, when used in the Contract Documents, are defined to mean as follows:

Addendum or Addenda A written or graphic instruction issued prior to the Bid Deadline which clarifies, amends or interprets the Contract Documents.

Alternate A proposed change in the work described in the Contract Documents providing the City with an option to select between alternative materials, products or systems, or to add or delete portions of the Work.

Alternative Dispute Resolution A method of resolving disputes other than arbitration or litigation.

Approved Equal Article, device, material, Equipment, form of construction or other item proposed by the Bidder and approved by the Engineer for incorporation or use in the Work as being equivalent to essential attributes of a standard specified in the Contract Documents.

As-built Drawings Drawings or computer files revised and submitted by the Contractor to show changes made during the construction process.

Authorized Representative Unless otherwise specified in the Contract Documents, the City Manager of the City or any of the City Manager's duly authorized assistants or designees.

Base Bid The amount of money stated in a Bid as the sum for which the Bidder offers to perform the Work described in the Contract Documents, exclusive of adjustments for Alternates.

Bid The offer of a Bidder to perform the Work for the amount or amounts quoted, as applicable.

Bidder A Person who submits a Bid for a Contract with the City.

Bid Deadline The date and time established as the deadline for submission of Bids, either through the Electronic Bidding Service or as otherwise provided by the City, subject to modification by Addendum.

Bid Guaranty Bid Bond or other instrument of security furnished by the Bidder to provide assurance that the Bidder will execute the Contract Form.

Board of Review Committee consisting of the City Manager, City Attorney and Director of the Department of Public Works or any of their respective authorized assistants or designees.

Borrow Area A location from which natural materials are to be removed for use in the Work.

Bridge A Structure, including supports, erected over a depression or an obstruction, as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads and having a length measured along the center of the roadway of more than 10 feet between undercopings of abutments or extreme limits of openings for multiple boxes.

Length. The length of a Bridge Structure is the over all length measured along the center line of Roadway of the surface of the Roadway.

Roadway width. The clear width measured at right angles to the longitudinal centerline of the Bridge between the bottom of curbs or guard timbers or, in the case of multiple heights of curbs, between the bottoms of the lower risers. For curb widths of 1 foot or less, the Roadway width shall be measured between the parapets or railings.

Building Department The City's Department of Building Services.

Bulletin A document issued by the Engineer after the execution of the Contract Form requesting a Proposal from the Contractor which, if approved as provided in the Contract Documents, will cause the execution of a Change Order to modify, amend or alter the Contract Documents. The Bulletin becomes a part of the Contract Documents when a Change Order related to the Bulletin is executed by all applicable Persons.

Certificate of Contract Completion A document signed by the Contractor and the Engineer certifying that Contract Completion has occurred.

Certificate of Partial Occupancy or Use A document signed by the Contractor and the Engineer certifying that City has chosen to occupy or utilize the Project or a designated portion thereof in accordance with 105.03.

Certified Test Data A test report from a manufacturer's Laboratory or an independent Laboratory approved by the City listing actual test results of samples tested for compliance with specified City requirements. The City will accept Certified Test Data from a manufacturer's Laboratory if its products have been used satisfactorily on prior City Contracts and its test data has been confirmed. The Contractor shall include a statement that the test data furnished is representative of the material furnished to a City Project or to a supplier. The report shall contain a characteristic number or date and shall identify the City Project or supplier to which the material is shipped. All reports shall be signed by an individual having legal authority to act for the manufacturer's Laboratory or independent Laboratory, as applicable.

Change Order A document issued by the City after execution of the Contract Form, which authorizes a change in the Work or an adjustment or alteration in the Contract price or the time for Contract Completion. A Change Order which requires only use of contingency funds (a "Field Change Order") may be approved by the Engineer. A Change Order which increases the Contract price must be approved by the City Manager and/or City Commission.

City The City of Dayton, an Ohio municipal corporation.

Claim Affidavit A sworn document containing a claim on funds that are due to a Contractor, created by statute in favor of a Person supplying labor, materials or services for the value of labor, materials or services supplied.

Conduit Any pipe or similar passageway for electricity, gas, water, Sewer or other utility.

Construction Schedule The schedule for the construction of the Work showing the time for completion of the Work, the planned sequence for performing the Work, the Contractor's resource loading curve and the interrelationship of the Contractor's activities with the activities of other Contractors, if any, the Engineer, and the City.

Contingency Fund Moneys reserved by the City within the contract to pay costs resulting from Change Orders, unanticipated conditions, compliance with rulings on building or other codes, incompleteness or inaccuracy of Contract Documents and settlements on judgments related to the Project.

Contract The agreement between the City and the Contractor as set forth in the Contract Documents.

Contract Bond Performance and payment bond or bonds, as applicable, furnished by the Contractor and the Contractor's Surety to provide assurance that the Contractor will perform the Contract and make required payments.

Contract Completion The date upon which all deficiencies noted in the Punch List have been corrected, the Contractor's Work is one hundred percent complete, the as-built drawings have been approved by the Engineer, and the Contractor has complied with all conditions precedent to final payment and release of retainage. When the Contract Documents specify a date for Contract Completion, Contract Completion shall occur on or before the specified date, even if the specified date is a Saturday, Sunday or legal holiday. When the Contract Documents provide that Final Acceptance shall occur a specified number of consecutive days after the date for commencement of Work set forth in the Notice to Proceed, that period of time shall be the time for Contract Completion.

Contract Cost Breakdown A statement furnished by the Contractor to the City reflecting the portions of the Contract price allocated to the various portions of the Work and used as the basis for reviewing the Contractor's Payment Requests.

Contract Documents Collectively, the Plans, plan notes, standard construction Drawings identified in Plans, Specifications, supplemental Specifications, Addenda, definitions,

Legal Notice, instructions to Bidders, equal opportunity requirements, electronic Bid, Bidder's affidavit, non-collusion affidavit, Bid guaranty, Substitution sheet, Contract Form, Contract Bond or Bonds, as applicable, wage rates and Special Provisions, Change Orders and approved Working Drawings, if any.

Contract Form The form furnished by the City that, when completed and signed by the Contractor and the City, evidences the entry into the Contract.

Contractor A Person with whom the City has entered into a Contract for the performance of Work on the Project in cooperation with other Persons and in accordance with the Contract Documents.

Culvert Any Structure not classified as a Bridge that provides an opening under a Roadway.

Day Calendar day, i.e., every day of the year, unless otherwise expressly specified to mean a business day. A business day is any day other than a Saturday, Sunday or legal holiday.

Defective When modifying the word Work, refers to Work that does not conform to the Contract Documents, or does not meet the requirements of any applicable statute, rule or regulation, policy, inspection, reference standard, test or approval, or has been damaged prior to Final Acceptance, unless responsibility for the protection thereof has been expressly assumed by the City, or that is not free from defects in workmanship, material or Equipment during the period of a Guarantee.

Director The Director of the City Department under which the Project is being performed, or the duly authorized designee of the applicable Director.

Drawings See Plans.

Electronic Bidding Service The electronic service used by the City to disseminate bidding information and documents to Bidders and to receive Bids and related documents from Bidders.

Engineer Unless otherwise specified in the Contract Documents, the Engineer of the Department of Public Works, the Water Engineering Manager of the Department of Water of the City of Dayton or the Planning and Engineering Manager of the Department of Aviation under which the Project is being performed, or the duly authorized designee of the Engineer or Manager, as applicable.

Engineer's Estimate An estimate of cost for a Project or a Contract for a Project prepared by the Engineer prior to Bid Deadline.

Equipment All machinery and Equipment, together with the necessary supplies for upkeep and maintenance, tools and apparatus necessary for the construction of the Work.

Fabricator The Subcontractor that fabricates structural metals or prestressed concrete members.

Final Acceptance The City's acceptance of the Work from the Contractor upon approval by the Authorized Representative of the Certificate of Contract Completion.

Final Inspection Final review of the Work of the Contractor by the Engineer to determine whether certification of Contract Completion is appropriate.

Guarantee Legally enforceable assurance, for a period after Contract Completion, of quality or performance of the Contractor's workmanship, material and Equipment.

Inspector A Person assigned by the Engineer to make detailed inspections of the Work.

Laboratory The testing Laboratory designated by the City or determined in accordance with the Contract Documents.

Legal Notice The public announcement inviting Bids for Work.

Liquidated Damages The sum established in the Contract Documents as the predetermined measure of damages to be paid to the City due to the Contractor's failure to complete the Work, or portions thereof, within a stipulated time.

Maintenance Bond A bond furnished by the Contractor and the Contractor's Surety to provide assurance that the Contractor will perform the Guarantee.

Materials Any substances, supplies, products or other items specified or reasonably intended for use in the construction of the Project and its appurtenances.

Material Supplier A Person who furnishes materials for Work on the Project, in any tier.

Mathematically Unbalanced The lump sum amount or Unit Price in a Bid that does not include reasonably sufficient amounts for labor, material, Equipment, overhead and other applicable costs and profit.

Notice of Commencement The notice prepared by the City identifying the Project, the Contractor, the Surety for the Contractor and the name of the Person upon whom a Claim Affidavit may be served.

Notice of Intent to Award The notice provided to the apparently successful Bidder stating that upon satisfactory compliance with all conditions precedent for execution of the Contract Form, within the time specified, the City intends to execute a Contract Form with the Bidder.

Notice to Proceed A notice provided by the Engineer to the Contractor authorizing the Contractor to proceed with the Work and establishing the date for commencement of the Work.

Or Equal See Approved Equal.

Owner See City.

Partial Occupancy or Use The stage in the progress of the Work when the Project, or a designated portion thereof, is sufficiently complete in accordance with the Contract Documents so the City can occupy or utilize the Project, or the designated portion thereof, for its intended use, if the City chooses.

Payment Request The form furnished by the City that is to be used by the Contractor in requesting progress payments and which when signed by the Contractor shall serve as an affidavit that payment requests are in proportion to the Work completed as shown by the Contract Cost Breakdown and that payments previously paid by the City have been applied by the Contractor to discharge in full all of Contractor's obligations incurred in connection with the Work covered by all prior Payment Requests.

Pedestrian Bridge A Bridge designed and constructed to provide means of traverse for pedestrian traffic only; also known as a foot Bridge.

Permittee Any Person issued a permit by the City to perform Work in accordance with these Specifications in a street, alley, Public Way or place, but not having a Contract with the City.

Person An individual, corporation, business trust, estate, limited liability company, partnership, association or other entity, public or private.

Plans The graphic and pictorial portions of the Contract Documents, showing the design, type of construction, location, dimension and character of the Work to be provided by the Contractor, generally including Drawings, elevations, sections, details, schedules, diagrams, notes, and Specifications, in whole or in part.

Profile Grade The trace of a vertical plane intersecting the top surface of the proposed wearing surface, usually along the longitudinal center line of a Roadbed. Profile Grade means either elevation or gradient of such trace according to the context.

Project The improvement to be constructed, of which the Work performed under the Contract Documents may be the whole or a part.

Project Schedule The schedule for the construction of the Project showing the time for completing the Work, the planned sequence for performing the Work, the Contractor's resource loading curve and the interrelationship between the activities of the Contractor, other Contractors, the Engineer, and the City.

Proposal The offer of the Contractor to complete the Work set forth in a Bulletin.

Proposed Equal Article, device, material, Equipment, form of construction or other item proposed by the Bidder for incorporation or use in the Work as being equivalent to essential attributes of a standard specified in the Contract Documents.

Public Way (or Place) A street, road, walk, alley or path used for public travel.

Punch List A list of items of Work to be completed or corrected by the Contractor as a condition precedent to Contract Completion.

Record Drawings Drawings or computer files revised by the Engineer to show the changes made during the construction process, based on the As-built Drawings furnished by the Contractor to the Engineer.

Request for Information Written request from the Contractor to the Engineer seeking an interpretation or clarification of the Contract Documents.

Right-of-Way Land, property, or interest therein, usually in a strip, acquired for or devoted to a road and includes the Roadway, Shoulders or berm, ditch and slopes extending to the Right-of-Way limits under control of the City.

Road A Public Way for purposes of vehicular travel, including the entire area within the Right-of-Way.

Roadbed The graded portion of a road within top and side slopes, prepared as foundation for the pavement Structure and Shoulder.

Roadside The areas between the outside edges of the Shoulders and Right-of-Way boundaries. Unpaved median areas between inside Shoulders of divided highways and infield areas of interchanges are included.

Roadside Development Those items necessary to the complete road that provide for the preservation of landscape materials and features; the rehabilitation and protection against erosion of all areas disturbed by construction through seeding, sodding, mulching and the placing of other ground covers; such suitable planting and other improvements as may increase the effectiveness and enhance the appearance of the road.

Roadway The portion of a road within the limits of construction.

Samples Physical examples furnished by the Contractor to illustrate materials, Equipment or workmanship and to establish criteria by which the Work will be judged.

Schedule of Values See Contract Cost Breakdown.

Sewer Pipe or Conduit intended for carrying storm drainage or sanitary drainage.

Shop Drawings Drawings, diagrams, illustrations, schedules, performance charts, brochures, catalog data and other data specially prepared or provided by the Contractor, a Subcontractor or Material Supplier to illustrate some portion of the Work.

Shoulder The portion of the road contiguous to the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Sidewalk That portion of the road constructed for the use by pedestrians.

Special Provisions Amendments to the Specifications or supplemental Specifications, which describe conditions unique to a particular Project.

Specifications Those portions of the Contract Documents consisting of the detailed written requirements and standards for materials, Equipment, construction systems and workmanship as applied to the Work and certain procedural details applicable thereto.

Standards The items named in the Specifications to denote kind, quality or performance requirement for the Work. All Bids and Proposals shall be based on the Standards as set forth in the Specifications.

State The State of Ohio.

Street See road.

Structure Bridge, Culvert, catch basin, curb inlet, drop inlet, retaining wall, cribbing, manhole, endwall, building, curb, pavement, Sewer, water main, service pipe, underdrain, foundation drain, and any other features which may be encountered in the Work and not otherwise defined herein.

Subcontractor A Person who undertakes to perform any part of the Work on the Project under a Contract with any Person other than the City, in any tier.

Subgrade The portion of a Roadbed upon which the pavement structure and Shoulders are constructed.

Substitution An item proposed by the Bidder to be used instead of a standard, but not considered in determining the lowest and best Bidder.

Substructure The part of a structure below the bearings of simple and continuous spans, skewbacks of arches and tops of footings of rigid frames, together with backwalls and wings.

Superintendent The Contractor's Authorized Representative in charge of the Work.

Superstructure The entire structure except the Substructure.

Supplemental Specifications Detailed Specifications supplemental to or amending or superseding the Specifications.

Surety A Person providing a Bid guaranty, Contract Bond or Maintenance Bond to a Bidder or Contractor, as applicable, to indemnify the City against all direct and consequential damages suffered by failure of the Bidder to execute the Contract Form or of the Contractor to perform the Contract and to pay all lawful claims of Subcontractors, Material Suppliers and laborers or to perform the Guarantee, as applicable.

Unit Price An amount stated in the Bid as the price per unit of measurement for Materials or services described in the Contract Documents, which cost shall include overhead, profit and any other expense for the applicable Work.

Warranty Legally enforceable assurance for the specified duration from Final Acceptance of quality or performance of Materials or Equipment.

Waste Area A location in which natural Materials are to be deposited when not used in the Work.

Work The construction services required by the Contract Documents, to include all labor, Materials, Equipment, tools, transportation, supplies, incidental and services performed or provided by the Contractor for the Project.

Working Drawings Stress sheets, shop Drawings, erection Plans, false work Plans, framework Plans, cofferdam Plans, bending diagrams for reinforcing steel, or any other supplementary Plans or similar data which the Contractor is required to submit for acceptance.

ITEM 103 INSTRUCTION TO BIDDERS

- 103.01 Contract Completion and Critical Path Scheduling**
- 103.02 Delay Claims**
- 103.03 Giving Notice**
- 103.04 Examination of Contract Documents**
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- 103.06 Subsurface and Concealed Physical Conditions**
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- 103.42 Time Limits**
- 103.43 Notice to Proceed and Submittals**
- 103.44 Wage Rates and Payment Dates**
- 103.45 Written Submissions in lieu of Electronic Bidding Service**

103.01 Contract Completion and Critical Path Scheduling. Unless otherwise provided in the Contract Documents, the time for completion of the Project indicated on the Bid or Electronic Bidding Service shall be the time for Contract Completion applicable to the Bidders. Critical path scheduling methods shall be utilized, unless waived by the Authorized Representative in writing.

103.02 Delay Claims. The only delays for which the Bidder is entitled to additional compensation are those delays which the Bidder has established were proximately caused by an improper action or failure to act by the Owner.

103.03 Giving Notice. Whenever any provision of the Contract Documents requires the giving of notice prior to the execution of the Contract Form, such notice shall be deemed to have been validly given if delivered personally to the Person for whom the notice is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address of such Person known to the giver of the notice. All notices provided to the Bidder by the Engineer shall be copied to the Authorized Representative. All notices provided to the Engineer by the Bidder shall be copied to the Authorized Representative. All notices provided to the Authorized Representative by the Bidder shall be copied to the Engineer.

103.04 Examination of Contract Documents. Contract Documents are available through the Electronic Bidding Service. The Bidder shall examine all Contract Documents, including without limitation the Drawings and Specifications for all divisions of Work for the Project, noting particularly all requirements which will affect the Bidder's Work in any way prior to submitting the Bidder's Bid. Failure of a Bidder to be acquainted with the amount and nature of Work required to complete any of the Work, in conformity with all requirements of the Project as a whole wherever set forth in the Contract Documents or reasonably inferred therefrom, will not be considered as a basis for additional compensation.

103.05 Evaluation of Work Season and Project Site. The Bidder shall evaluate when the Work may be performed and examine and evaluate the Project site and related Project conditions where the Work will be performed prior to submitting the Bidder's Bid, including without limitation the following:

- (a) The condition, layout and nature of the Project site and surrounding area, including Borrow Areas and Waste Areas, if any;
- (b) The availability and cost of labor;
- (c) The availability and cost of Materials, supplies and Equipment;
- (d) The cost of temporary utilities required;
- (e) The cost of any permit or license required by a local or regional authority having jurisdiction over the Project;
- (f) The usual weather conditions;
- (g) Conditions bearing upon transportation, disposal, handling, and storage of Materials and waste.

103.06 Subsurface and Concealed Physical Conditions. The Contractor may rely upon the general accuracy of the technical data contained in reports and drawings provided to the Contractor by the Owner and, except for such reliance on technical data, the Contractor shall not rely upon or make any claim against the City with respect to: (1) the completeness of such reports and drawings for the Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by the Contractor, and safety precautions and programs incident thereto; or (2) other data, interpretation, opinions, and information contained in such reports or shown or indicated in such drawings; or (3) any Contractor interpretation of or conclusion drawn from any technical data or any such other data, interpretations, opinions, or information. For example, all interpolations and extrapolations of data performed by the Contractor to estimate locations or quantities of subsurface strata are independent factual assumptions which the Owner does not warrant. Subject to the foregoing, if during the progress of the Work subsurface or concealed physical conditions are encountered at the site differing materially from those indicated in the Contract Documents, or if subsurface or concealed physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the Work provided for in the Contract Documents, are encountered at the site, the Contractor shall notify the Engineer of the specific differing conditions before they are disturbed or the affected Work is performed. Upon notification, the Engineer will investigate the conditions and if it is determined that the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of any Work under the Contract, a Change Order may be issued in accordance with Item 117. The City may decline to issue a Change Order if the notice required by 117.11 is not timely provided by the Contractor. If the Contractor fails to timely provide the notice required by 117.11, the Contractor shall be deemed to have waived any and all claims for additional compensation or time extension for the related subsurface or concealed physical conditions.

103.07 Pre-Bid Meeting. All Bidders are required to attend the pre-Bid meeting, where the Engineer will answer questions regarding the Contract Documents. If not given in the Legal Notice, notice of the time and place of any pre-Bid meeting to be held will be given by the Engineer to each Person of record holding Contract Documents. A Bidder's failure to attend the pre-Bid meeting will result in his or her bid being rejected as non-responsive.

103.08 Request for Information or Clarification. If the Bidder finds any perceived ambiguity, conflict, error, omission or discrepancy on or between any of the Contract Documents, including without limitation the Drawings and Specifications, or between any Contract Documents and any applicable provision of law, the Bidder shall submit a written request to the Engineer for an interpretation or clarification. Such requests must be submitted to the Engineer at least seven Days before the Bid Deadline.

103.09 Interpretation or Clarification by Addendum. If the Engineer determines that an interpretation or clarification is warranted, the Engineer shall issue an Addendum through the Electronic Bidding Service. Any interpretation or clarification of the Contract Documents made by any Person other than the Engineer, or in any manner other than an Addendum issued through the Electronic Bidding Service, shall not be binding and the Bidder shall not rely upon any such interpretation or clarification. The Bidder shall not, at any time before or after the execution of the

Contract Form, be compensated for a claim alleging insufficient data, incomplete, ambiguous, conflicting or erroneous Contract Documents, any discrepancy on or between Contract Documents or incorrectly assumed conditions regarding the nature, extent or character of the Work, if no request for interpretation or clarification regarding such matter was made by the Bidder prior to the Bid Deadline in compliance with 103.08.

103.10 Standards. The articles, devices, Materials, Equipment, forms of construction, fixtures and other items named in the Specifications to denote kind, quality or performance requirement for each significant portion of the Work shall be known as Standards and all Bids shall be based upon those Standards. Where two or more Standards are named, the Bidder may furnish any one of those Standards. Items which are not Standards may be used only if accepted pursuant to the requirements of 103.11 and 103.12.

103.11 Proposed Equals. If the Bidder proposes to use an article, device, material, Equipment, form of construction, fixture or item other than those Standards named in the Specifications, the Bidder shall submit such a proposal to the Engineer, not later than ten Days prior to the Bid Deadline, certifying that the item is equal in quality, and in all aspects of performance and appearance, to the Standards specified. In addition, the Bidder shall submit information to the Engineer not later than ten Days prior to the Bid Deadline, which information shall include:

- (a) The name and a complete description of the Proposed Equal, including Drawings, performance and test data, and other information necessary for a complete evaluation of the Proposed Equal;
- (b) A statement setting forth any changes which the Proposed Equal will require in the Contract Documents or the Project.

103.12 Approval or Disapproval of Proposed Equals. If the Engineer, in the exercise of the Engineer's sole unfettered discretion, approves the Proposed Equal as a Standard, the Engineer shall issue an Addendum to that effect through the Electronic Bidding Service. If the Engineer does not approve the Proposed Equal as a Standard, the Engineer shall inform the Bidder of the disapproval in writing, no later than ninety-six hours prior to the Bid Deadline, excluding Saturdays, Sundays and legal holidays, which decision shall be final. The Engineer shall have the discretion to reject a Proposed Equal for any reason, including, but not limited to, the Bidder's failure to provide sufficient information to enable the Engineer to completely evaluate the Proposed Equal without delaying the scheduled Bid Deadline.

103.13 Substitutions. If no Addendum is issued approving the Proposed Equal as a Standard, the Bidder may list the item on the Substitution sheet. A Bidder desiring consideration for the use of an article, device, material, Equipment, form of construction, fixture or item other than those Standards named in the Specifications shall submit a Proposal for the Substitution of same for the applicable standard, using the Substitution sheet provided in the Electronic Bidding Service and listing, for each proposed Substitution: the standard specified, the Substitution, and the change in Bid amount, (or indicate no change, if applicable). The name and a complete description including Drawings, performance and test data, and other information necessary for

a complete evaluation of each Substitution shall be furnished to the Engineer by the Bidder promptly upon request. Any Substitution accepted by the City must be incorporated in the Contract in writing. Substitutions shall not be considered in determining of the lowest and best Bid but may be considered in rejecting all Bids.

103.14 Electronic Bid. Each Bid shall contain the name of every Person interested therein and be submitted through the Electronic Bidding Service. Instructions for using the Electronic Bidding Service are available on the City's website. Failure to properly submit a Bid through the Electronic Bidding Service may cause a Bid to be rejected as nonresponsive. Unless the Bidder withdraws the Bid as provided in 103.31, the Bidder will be 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 which might indicate a contrary intention.

103.15 Alternates. When an Alternate is listed in the Electronic Bidding Service, the Bidder shall complete the applicable portion, indicating an amount which will increase or decrease the Base Bid. The City reserves the right to accept or reject any or all Bids on Alternates, in whole or in part, and the right to reject any Alternate or Alternates and to accept any remaining Alternate or Alternates. Alternates may be accepted or rejected in any order.

103.16 Submission of Bid. If the Bidder is a corporation, limited liability company, partnership or sole proprietorship, an officer, member, partner or principal of the Bidder, as applicable, shall submit and electronically sign the Bid through the Electronic Bidding Service. If the Bidder is a joint venture, an officer, member, partner or principal, as applicable, of each participant of the joint venture shall electronically sign the Bid on behalf of that participant, where applicable. By submitting a Bid, the Bidder warrants that it is not now, and will not become subject to an unresolved finding for recovery under Section 9.24 ORC, prior to the award of any Contract arising out of this Project, without notifying the City of such findings. Section 9.24, ORC prohibits the City from awarding a Contract to any Bidder against whom the Auditor of State has issued findings for recovery if the findings for recovery are unresolved at the time of award. The completed Bid submission of the Bidder with whom the City executes a Contract Form shall be incorporated into the Contract Form as if fully rewritten therein.

103.17 Submittals with Bid. Where indicated in the Electronic Bidding Service, the Bidder must download all documents that are shown as requiring a download and submit every document that is shown as requiring submission. A Bid shall be rejected if the Bidder fails to submit, or submits not fully complete, any document that is shown as requiring submission.

103.18 Unit Prices. When Unit Prices are requested in the Electronic Bidding Service, any scheduled quantities listed by the City are not binding upon the City and are to be used only for the comparison of Bids for purposes of determining the lowest and best Bidder and to determine the maximum quantity to be provided without a Change Order. If Unit Prices are stated to be sought only for informational purposes, they shall not be used for comparison of Bids. Unless otherwise specified in the Contract Documents, the Unit Prices and the totals or extensions thereof set forth shall include all Materials, Equipment, insurance, labor, delivery, installation, overhead, profit and any other cost or expense, in connection with or incidental to,

the performance of that portion of the Work to which the Unit Prices apply. The Bidder shall submit Unit Prices for all items listed unless other instructions are stated.

103.19 Changes to Unit Price Work. The Bidder agrees that the City may increase, decrease or delete entirely the scheduled quantities of Work to be done and Materials to be furnished after execution of the Contract Form without invalidating the Contract. Payments, except for lump sum items in Unit Price Contracts, will be made to the Contractor only for the actual quantities of Work performed or Materials furnished in accordance with the Contract Documents, but not in excess of the maximum set by the scheduled quantities. The Contractor must obtain a Change Order prior to performing Work or furnishing Materials in excess of the scheduled quantities in order to be compensated for the excess.

103.20 Change in Bid Amount. The Bidder may amend or withdraw its Bid through the Electronic Bidding Service at any time prior to the Bid Deadline.

103.21 Timely Submission of Bids. It is the responsibility of the Bidder to submit its Bid through the Electronic Bidding Service prior to the Bid Deadline. Bids arriving after the Bid Deadline shall not be considered.

103.22 Bid Letting. Bidders may submit Bids through the Electronic Bidding Service up to the Bid Deadline. At the Bid Deadline, all Bids will be tabulated and the tabulation made public. The public bid tabulation is for informational purposes only and is not to be construed as an acceptance or rejection of any Bid submitted. The electronic Bid submissions shall be a public record and open for inspection, upon request, at any time after the Bid Deadline, except for any information which is not subject to disclosure as provided by applicable law.

103.23 Bid Deadline Extension. If any Addendum is issued within Seventy-two hours prior to the published Bid Deadline, excluding Saturdays, Sundays and legal holidays, the Bid Deadline shall automatically be extended one week, with no further advertising required. If any Addendum is issued more than seventy-two hours prior to the published Bid Deadline, excluding Saturdays, Sundays, and legal holidays, the Bid Deadline may be revised by the Addendum, at the City's discretion.

103.24 Bid Evaluation Criteria. The City reserves the right to accept or reject any or all Bids, in whole or in part, and reserves the right to reject any Bid or Bids and to award the Contract to any remaining Bidder the City determines to be the lowest and best Bidder. The City reserves the right to accept or reject any or all Alternates, in whole or in part, and the right to reject any Alternate or Alternates and to accept any remaining Alternate or Alternates. Alternates may be accepted or rejected in any order. The City may reject the Bid of any Bidder who has engaged in collusive Bidding, been involved in violations of ethics laws or who has an unresolved finding against it by the Auditor of State as provided in Section 9.24, ORC, as not the lowest and best Bid. The City 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 requirements of the Contract Documents may cause a Bid to be rejected.

103.25 Bid Evaluation Procedures. The Contract will be awarded to the lowest and best Bidder as determined in the discretion of the City or all Bids will be rejected in accordance with the procedures set forth in 103.26 through 103.31.

103.26 Lowest Bidder. In determining which Bidder is the lowest, the City shall consider the Base Bid and any Alternate or Alternates which the City determines to accept. Substitutions shall not be considered. The total of the Bids for the accepted Alternate(s) shall be added to or deducted from the Base Bid, as applicable, for the purpose of determining the lowest Bidder. If the Project involves multiple Contracts, the City may also receive combined Bids for two or more Contracts, if provided in the Electronic Bidding Service, but no Contract for the entire job or for more than one Contract shall be awarded unless the separate Bids do not cover all the Work and Materials required or unless the combined Bid is lower than the applicable separate Bids in the aggregate. The City may also receive Bids for multiple Projects if provided in the Electronic Bidding Service.

103.27 Rejection of Bids. In addition to any other reason provided for in this Item, a Bid shall be rejected if:

- (a) the Bid fails to respond to the Contract Documents in all material respects;
- (b) the Bid contains irregularities or deviations from the Contract Documents which would affect the amount of the Bid or otherwise give the Bidder a competitive advantage;
- (c) the Bid contains a Bid guaranty executed by a Surety not licensed in Ohio; or
- (d) a Bid guaranty that is otherwise determined to be insufficient by the City.

In addition to any other reason provided for in this Item, a Bid may be rejected if:

- (a) the Bid is Mathematically Unbalanced;
- (b) the Bid does not contain an executed Non-collusion affidavit;
- (c) the Bidder fails to furnish Samples and a complete statement of the origin, composition and manufacture of any or all Materials to be used for the Work, when so requested; or
- (d) the Samples provided by the Bidder fail to demonstrate that Materials are of sufficient quality or fitness for the Work.

103.28 Best Bidder. In determining whether a Bidder is best, factors to be considered include, without limitation:

- (a) Preferences required by law, where applicable;
- (b) The experience of the Bidder;

- (c) The financial condition of the Bidder;
- (d) Compliance by the Bidder and related Persons with ethics laws and City ordinances and regulations, including without limitation submission of an affirmative action program in accordance with Section 35.16 R.C.G.O.;
- (e) The conduct and performance of the Bidder on previous Bids and Contracts with the City or other owners, which shall include, without limitation, compliance with prevailing wage laws, Workers' compensation, income tax laws and equal opportunity requirements;
- (f) The facilities of the Bidder, including without limitation machinery, plant and Equipment, as applicable;
- (g) The management skills of the Bidder;
- (h) The ability of the Bidder to execute the Contract properly, including whether the Bidder's existing workload may hinder or prevent timely completion of the Work;
- (i) The ability of the Bidder to perform at least fifty-one percent of the Work with its own employees;
- (j) The evaluation of a Bid below the median of other Bids pursuant to 103.37.

A Bidder who submits a Bid for Work for electrical, plumbing, hydronics, refrigeration or heating, ventilating and air conditioning shall provide evidence of a valid Contractor's license from the Ohio Construction Industry Licensing board or successor.

103.29 Information. A Bidder shall submit to the Engineer, upon request, any information the Authorized Representative deems appropriate to the consideration of factors showing that such Bidder's Bid is best, including without limitation the following:

- (a) Overall experience of the Bidder, including number of years in business under present and former business names;
- (b) Names and qualifications of key Bidder personnel;
- (c) Complete listing of all ongoing and completed public and private construction Contracts of the Bidder in the last three years, including the nature, status and value of each Contract and a name, address, and phone number for a representative of the Owner of each related Project;
- (d) Complete listing of any EPA, (OSHA) or other regulating entity issues or citations in the last ten years;
- (e) Complete listing of all outstanding liens against the Bidder;
- (f) Certified financial statement with trade and bank references;
- (g) Description of relevant facilities of the Bidder;

(h) Description of the management experience of the Bidder's Project manager(s) and Superintendent(s); who will be assigned to the Project;

(i) Complete list of all Subcontractors and Material Suppliers;

(j) To support a Contract Bond, a current and signed certificate of compliance required under Section 9.311 ORC, issued by the Department of Insurance, showing the Surety is licensed to do business in Ohio;

(k) Current Ohio Workers' Compensation Certificate.

If the Bidder is a foreign corporation, i.e., not incorporated under the laws of Ohio, a certificate of good standing from the Secretary of State showing the right of the Bidder to do business in the State; or, if the Bidder is an individual or partnership, the Bidder has filed with the Secretary of State a Power of Attorney designating the Secretary of State as the Bidder's agent for the purpose of accepting service of summons in any action brought under Section 153.05, ORC, or under Sections 4123.01 through 4123.94, inclusive, ORC.

The Engineer may obtain such information from several Bidders simultaneously. Each Bidder shall provide requested information within such time limits as the Engineer shall establish.

103.30 Notice of Intent to Award. The City shall notify the apparent lowest and best Bidder that upon satisfactory compliance with all conditions precedent for execution of the Contract Form, within the time specified, the Bidder will be awarded the Contract. The City reserves the right to rescind any Notice of Intent to Award at any time prior to the execution of the Contract if the City determines the Notice of Intent to Award was issued in error.

103.31 Withdrawal of Bid. A Bidder may withdraw its Bid at any time prior to the Bid Deadline through the Electronic Bidding Service. All Bids submitted through the Electronic Bidding Service which were not withdrawn prior to the Bid Deadline shall remain valid and open for acceptance for a period of at least sixty Days after the Bid Deadline; provided, however that during that period a Bidder may withdraw a Bid from consideration 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. Notice of such a request to withdraw a Bid must be made in writing filed with the Authorized Representative within two business Days after the Bid Deadline. The City reserves the right to request that the Bidder submit evidence substantiating the Bidder's request to withdraw the Bid. No Bid may be withdrawn after the Bid Deadline when the result would be the awarding of the Contract on another Bid to the same Bidder. If a Bid is withdrawn after the Bid Deadline, the City may award the Contract to another Bidder that the City determines to be the lowest and best Bidder, or reject all Bids and advertise for other Bids. If the City advertises for other Bids, the withdrawing Bidder shall pay the costs incurred by the City in connection with the rebidding if the City finds that such costs would not have been incurred but for such withdrawal. A Bidder may withdraw its Bid at any time after the expiration of the described sixty Day period by written notice to the Authorized Representative.

103.32 Refusal to Accept Withdrawal. If the City intends to contest the right of the Bidder to withdraw a Bid after the Bid Deadline, a hearing shall be held by the Authorized Representative within ten Days after the Bid Deadline and an order shall be issued by the City allowing or denying the claim of such right within five Days after such hearing is concluded. The City shall give the withdrawing Bidder timely notice of the time and place of any such hearing. The City 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. If the City denies the claim for withdrawal and the Bidder elects to litigate or otherwise refuses to perform the Contract, the City may reject all Bids or award the Contract to the next lowest and best Bidder, as determined by the City, without waiving any claims against the non-performing Bidder.

103.33 Effect of Withdrawal. No Bidder who is permitted to withdraw a Bid after the Bid Deadline shall for compensation supply any material or labor to, or perform any subcontract or other Work agreement 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 written approval of the City. The Person to whom the Contract is awarded and the withdrawing Bidder shall be jointly liable to the City in an amount equal to any compensation paid to or for the benefit of the withdrawing Bidder without such approval. A Bidder who is permitted to withdraw a Bid after Bid Deadline may be considered not the best for future City Contracts.

103.34 Bid Estimate. In no instance shall Contracts be let either as a whole, or in aggregate, if Bids for parts of the Work are taken, which exceed one hundred ten percent of the estimate for the improvement contemplated.

103.35 Review of Low Bid. The City may reject a Bid which is

- (a) more than twenty percent below the median of all higher Bids received for a Contract where the estimate is one hundred thousand dollars or more; or
- (b) more than twenty-five percent below the median of all higher Bids received for a Contract where the estimate is less than one hundred thousand dollars.

In determining whether to reject such a bid, the City may at its discretion, but is not required to:

- (a) Conducts an interview with the Bidder to determine what, if anything has been overlooked in the Bid, and to analyze the process planned by the Bidder to complete the Work;
- (b) Require the Bidder to submit to the City a certified financial statement and a list of recent public Contracts which the Bidder has performed; and/or

(c) Notify the Bidder's Surety in writing that the Bidder with whom the City intends to enter a Contract submitted a Bid determined to be substantially lower than the median of all higher Bids.

103.36 Bid Guaranty. The Bidder must file with the Bid a Bid guaranty, payable to the City of Dayton, in the form of the signed Bid guaranty and Contract Bond contained in the Contract Documents, for the full amount of the Base Bid plus add Alternates. The Bid guaranty shall be submitted through the Electronic Bidding Service. The Bid guaranty shall be in form and substance satisfactory to the City and shall serve as an assurance that the Bidder will, upon acceptance of the Bidder's Bid, comply with all conditions precedent for execution of the Contract Form and execute the Contract Form within the time specified by the City. ANY BID GUARANTY MUST BE PAYABLE TO THE CITY OF DAYTON. A Bid may be rejected if the Bid guaranty is payable to any other Person. IF THE BLANK LINES FOR THE AMOUNT ON THE BID GUARANTY AND CONTRACT BOND ARE NOT FILLED IN, THE PENAL SUM WILL AUTOMATICALLY BE THE FULL AMOUNT OF THE BASE BID PLUS ADD ALTERNATES. If those blank lines are filled in, the amount must not be less than the full amount of the Base Bid plus add Alternates, stated in dollars and cents. A PERCENTAGE IS NOT ACCEPTABLE. The Bid guaranty and Contract Bond must be signed by an authorized agent with Power of Attorney from a Surety. The Bid guaranty and Contract Bond must be issued by a Surety authorized by the Department of Insurance to transact business in Ohio. The requirements of Section 3905.41, ORC, may be applicable to require the Bid guaranty and Contract Bond be countersigned by an Ohio resident agent. The Bidder must determine whether this requirement is applicable to the Bidder's Surety. Bid guaranties will be returned to all unsuccessful Bidders seventy-five Days after the Bid Deadline or upon execution of the Contract Form by the apparently successful Bidder, whichever is earlier.

103.37 Bid Guaranty Forfeiture. If for any reason, other than as authorized by 103.31 or 103.38, the Bidder fails to execute the Contract Form, and the City awards the Contract to another Bidder which the City determines is the lowest and best Bidder, the Bidder who failed to execute the Contract Form shall be liable to the City for the difference between such Bidder's Bid and the Bid of the lowest and best Bidder, or for a penal sum not to exceed ten percent of the defaulting Bidder's Bid amount, whichever is less. If the City then awards a Contract to another Bidder which the City determines is the lowest and best Bidder and such Bidder also fails or refuses to execute the Contract Form, the liability of such lowest and best Bidder shall, except as provided in 103.38, be the amount of the difference between the Bid amounts of such lowest and best Bidder and another Bidder which the City determines is the lowest and best Bidder, but not in excess of the liability specified in 103.31. Liability on account of an award to each succeeding lowest and best Bidder shall be determined in like manner. If the City does not award the Contract to the another Bidder which the City determines is the lowest and best Bidder but resubmits the Project for Bidding, the Bidder failing to execute the Contract Form shall, except as provided in 103.38, be liable to the City for a penal sum not to exceed ten percent of such Bidder's Bid amount or the costs incurred by the City in connection with the rebidding, whichever is less.

103.38 Exception to Bid Guaranty Forfeiture. A Bidder with the City for a Contract with the City costing less than five hundred thousand dollars may withdraw a Bid from consideration if the Bidder's Bid for some other Contract with the State or any political subdivision, district, institution or agency thereof, excluding ODOT, costing less than five hundred thousand dollars has already been accepted, if the Bidder certifies in good faith that the total price of all such

Bidder's current Contracts is less than five hundred thousand dollars, and if the Bidder's Surety certifies in good faith that the Bidder is unable to perform the subsequent Contract because to perform such Contract would exceed the Bidder's Bonding capacity. If a Bid is withdrawn pursuant to 103.38, the City may award the Contract to another Bidder which the City determines is the lowest and best Bidder or reject all Bids and resubmit the Project for Bidding, and neither the withdrawing Bidder nor such Bidder's Surety shall be liable for the difference between the Bidder's Bid and that of another Bidder which the City determines is the lowest and best Bidder, for a penal sum, or for the costs incurred by the City in connection with the rebidding.

103.39 Contract Bond. If the Bidder executes the Contract Form, the Bidder shall, at the time of signing the Contract Form, provide the Contract Bond required by law in form and substance, and from a Surety, satisfactory to the City. The Contract Bond shall be in the full amount of the Contract to indemnify the City against all direct and consequential damages suffered by failure of the Contractor to perform according to the provisions of the Contract Documents and in accordance with the Plans, Specifications, details and bills of material therefore and to pay all lawful claims of Subcontractors, Material Suppliers, and laborers for labor performed or Materials furnished in carrying forward, performing or completing the Contract. A Contract Bond must be signed by an authorized agent with Power of Attorney from the Surety.

103.40 Personal Property Tax Statement. The successful Bidder shall provide a properly completed and executed affidavit in a form satisfactory to the City in order to fulfill the requirements of Section 5719.042 ORC, which provides as follows:

After the award by a taxing district of any Contract let by competitive Bid and prior to the time the Contract is entered into, the Person making a Bid shall submit to the district's fiscal officer a statement affirmed under oath that the Person with whom the Contract is to be made was not charged at the time the Bid was submitted with any delinquent personal property taxes on the general tax list of personal property of any county in which the taxing district has territory or that such Person was charged with delinquent personal property taxes on any such tax list, in which case the statement shall also set forth the amount of such due and unpaid delinquent taxes and any due and unpaid penalties and interest thereon. If the statement indicates that the taxpayer was charged with any such taxes, a copy of the statement shall be transmitted by the fiscal officer to the county treasurer within thirty Days of the date it is submitted.

A copy of the statement shall also be incorporated into the Contract, and no payment shall be made with respect to any Contract to which 103.40 applies unless such statement has been so incorporated as a part thereof.

103.41 Conditions Precedent for Execution of Contract Form by City. The award of the Contract and the execution of the Contract Form are based upon the expectation that the lowest and best Bidder will execute the Contract Form and comply with all conditions precedent for execution of the Contract Form within ten Days of the date of the issuance of the Notice of Intent to Award. Failure to execute the Contract Form or noncompliance with the conditions precedent for execution of the Contract Form within ten Days of the date of the issuance of the Notice of Intent to Award shall be cause permitting the City to cancel the Notice of Intent to Award for the Bidder's failure to be best, and to award the Contract to another Bidder which the City determines is the lowest and best Bidder or to resubmit the Contract for Bidding, at the discretion

of the City. The City may extend the time for submitting the conditions precedent for execution of the Contract Form for good cause shown. No extension shall operate as a waiver of the conditions precedent for execution of the Contract Form. The conditions precedent for execution of the Contract Form by the City are as follows:

- (a) Contract Form;
- (b) Contract Bond and to support the Contract Bond, a power of attorney for any attorney-in-fact signing the Contract Bond and a certificate of compliance issued by the Ohio Department of Insurance showing the Surety is licensed to do business in Ohio;
- (c) Ohio Workers' Compensation Certificate;
- (d) Certificate of Insurance (ACORD form is acceptable) clearly setting forth all exclusions and deductibles and copy of additional insured or loss payee endorsement. The City reserves the right to request a certified copy of the Contractor's insurance policies, including all endorsements.
- (e) If the Bidder is a foreign corporation, i.e., not incorporated under the laws of Ohio, a Certificate of good standing from the Secretary of State showing the right of the Bidder to do business in the State will be required. If the Bidder is an individual or partnership, the Bidder has filed with the Secretary of State a Power of Attorney designating the Secretary of State as the Bidder's agent for the purpose of accepting service of summons in any action brought under Section 153.05 ORC, or under Sections 4123.01 through 4123.94, inclusive, ORC.
- (f) Personal property Tax Statement; and
- (g) Evidence of registration of the Contractor and all of the Contractor's Subcontractors with the Building Department and the City's Department of Finance, Division of Revenue and Taxation.
- (h) Material Declaration of Assistance/Non-Assistance to Terrorist Organization, when required.
- (i) If requested by the City, the Bidder shall immediately submit evidence that the Person signing the Contract is authorized to bind the Bidder.

103.42 Time Limits. A Contract Form is not executed until it has been signed on behalf of both the Bidder and the City by Persons authorized to bind the Bidder and the City, respectively. The failure to award the Contract and to execute the Contract Form within ninety Days of the Bid Deadline invalidates the entire Bid process and all Bids submitted, unless the time is extended by written consent of the apparent lowest and best Bidder and the City concurs with such extension. If the Contract is awarded and the Contract Form is executed within ninety Days of the Bid Deadline, any increases in material, labor and subcontract costs shall be borne by the Bidder without alteration of the amount of the Bid. If the cause of the failure to execute the Contract within ninety Days of the Bid Deadline is due to matters for which the City is solely responsible, the Contractor shall be entitled to a Change Order authorizing payment of verifiable increased costs in Materials, labor or subcontracts. If the cause of the failure to execute the

Contract within ninety Days of the Bid Deadline is due to matters for which the Contractor is responsible, no request for increased costs will be granted.

103.43 Notice to Proceed and Submittals. The Authorized Representative shall issue the Contractor a Notice to Proceed which shall establish the date for commencement of the time for Contract Completion. The Contractor shall, within ten Days of the date of the Notice to Proceed, furnish the Engineer the following submittals:

- (a) Contract Cost Breakdown;
- (b) Preliminary schedule including shop Drawings and submittals;
- (c) List of Subcontractors;
- (d) List of Material Suppliers;
- (e) Outline of qualifications of proposed Superintendent.

103.44 Wage Rates and Payment Dates. The Bidder shall base its Bid upon the prevailing rates of wages as ascertained by the Ohio Department of Commerce, Division of Labor & Worker Safety, Wage and Hour bureau or the U.S. Department of Labor, as applicable, for the Project as provided in Sections 4115.03 and 4115.14, ORC, or the Davis-Bacon Act, respectively. The Contractor shall, within ten Days of the date of the Notice to Proceed, provide to the Engineer for the prevailing Wage Coordinator a schedule of dates during the term of the Contract on which wages will be paid to employees for the Project.

103.45 Written Submissions in lieu of Electronic Bidding Service. Where a Bidder is required by a provision in this Item 103 to make a submission through the Electronic Bidding Service, such submission may be made in paper form only upon prior written authorization from the Engineer. The determination whether to grant such prior written authorization is left to the Engineer and may be exercised by the Engineer's sole unfettered discretion. Submissions outside the Electronic Bidding Service without such prior written authorization may result in a determination that the Bid is non-responsive.

ITEM 104 GENERAL REQUIREMENTS

104.01 Contract Documents

104.02 Applicable Law and ODOT Matters

104.03 Jurisdiction

104.04 Assignment of Antitrust Claims

104.05 Captions

104.06 Nondiscrimination Generally

104.07 City's Nondiscrimination Requirements

104.08 Notice of Commencement

104.09 Giving Notice

104.10 Computation of Time

104.11 Facsimile Transmission and Electronic Mail

104.12 Intent

104.13 Requests for Information

104.14 Ownership and Use of Drawings and Specifications

104.15 Access to Documents

104.16 As-Built Drawings

104.17 Substitutes for Standards or Approved Equals

104.18 Sales and Use Taxes

104.01 Contract Documents. The Contractor, the Engineer and the Authorized Representative shall be familiar with all provisions of the Contract Documents.

104.02 Applicable Law and ODOT Matters. The Contractor and the City shall comply with all applicable Federal, State and local codes, statutes, ordinances and regulations in the performance of the Work on the Project. When the Federal government or the State pays all or any portion of the cost of the Project, the Work shall be subject to the inspection of the appropriate federal or State agency. No such inspection shall make the Federal government or State a party to the Contract and will in no way affect the rights and obligations of the City and the Contractor under the Contract. Any such inspection is solely for the benefit of the City and the Federal or State agency making it, and neither the Contractor nor the Surety shall be entitled to rely upon it for any purpose. References to ODOT matters shall be as set forth in the CMS current as of the Bid Deadline. In such instances, the CMS is incorporated only to the extent that it is not inconsistent with the Specifications.

104.03 Jurisdiction. The Montgomery County Court of Common Pleas, or the United States District Court for the Southern District of Ohio if required by law, shall be the exclusive jurisdiction in which any action or proceeding concerning any Bid, Contract, agreement or performance under the Contract Documents or in connection with the Project shall be filed. In any such action or proceeding the Contract Documents shall be construed in accordance with the laws of the State which shall govern to the exclusion of the law of any other jurisdiction.

104.04 Assignment of Antitrust Claims. By executing the Contract Form, the Contractor assigns, conveys and transfers to the City 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 City pursuant to the Contract.

104.05 Captions. Captions throughout the Contract Documents are for convenience and reference only and the words contained in a caption shall in no way be held to explain, modify, amplify or aid in the interpretation, construction or meaning of the provisions of the Contract Documents. Rights and responsibilities of the Contractor, the Engineer and the City are set forth throughout the Contract Documents and are included under different titles, articles and paragraphs for convenience.

104.06 Nondiscrimination Generally. During the performance of the Contract, the Contractor agrees that in the hiring of employees for the performance of Work, including without limitation Work to be performed by a Subcontractor, no Contractor or Subcontractor, and no Person acting on behalf of the Contractor or Subcontractor, shall, by reason of race, religion, national origin, age, sex, disability, or color, discriminate against any citizen in the employment of labor or workers who are qualified and available to perform the Work to which the employment relates. The Contractor further agrees that no Contractor or Subcontractor, and no Person acting on behalf of the Contractor or Subcontractor, shall, in any manner, discriminate against or intimidate any employee hired for the performance of Work on account of race, religion, national origin, age, sex, disability, or color. In the event of the Contractor's noncompliance with the nondiscrimination clauses, the contract may be terminated or suspended in whole or in part, and the Contractor may be declared ineligible for further City Contracts or such other sanctions as provided by law. Any provision of a hiring hall Contract or agreement which obligates a Contractor to hire, if available, only such employees as are 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 such hiring hall Contract or agreement, or within thirty Days thereafter, such labor organization has in effect procedures for referring qualified employees for hire without regard to race, color, religion, national origin, or ancestry and unless such labor organization includes in its apprentice and journeymen membership, or otherwise has available for job referral without discrimination, qualified employees.

104.07 City's Nondiscrimination Requirements. The Contractor shall comply with RCGO, Section 35.14 which provides as follows and any amendments thereto:

(A) The [Contractor] shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, ancestry, national origin, place of birth, age, marital status, or handicap. The [Contractor] shall take affirmative action in accordance with terms outlined in its [Proposal] and the provisions of this [Contract] to insure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, sexual orientation, gender identity, ancestry, national origin, place of birth, age, marital status, or handicap. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The [Contractor] agrees to post in conspicuous places, available to employees and applicants, notices to be provided by the [City] setting forth the provisions of the nondiscrimination clauses.

(B) The [Contractor] shall in all solicitations or advertisements for employees placed by or on behalf of the [Contractor], state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, ancestry, national origin, place of birth, age, marital status, or handicap.

(C) The [Contractor] shall send to each labor union or representative of workers with which [the Contractor] has a collective bargaining agreement or other contract or understanding, a notice to be provided by the [City] advising the labor union or workers' representative of the [Contractor's] commitments, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(D) The [Contractor] shall comply with all rules, regulations, and relevant orders promulgated by the Human Relations council pursuant to its duties created by ordinance.

(E) The [Contractor] shall file, and shall cause each of [the Subcontractors and Material Suppliers] to file, compliance reports with the Human Relations Council as may be directed. Compliance reports shall be filed within such times and shall contain such information as to the practices, policies, programs, and employment policies, programs and employment statistics of the [Contractor, Material Supplier, or Subcontractor] and shall be in such form as the Human Relations Council may prescribe.

(F) The [Contractor] shall furnish all information and reports required by this [Contract] and by the rules, regulations, and orders of the Human Relations Council pursuant hereto, and shall permit reasonable access to the [Contractor's] books, records, and accounts by the Human Relations Council or its representative, as necessary for purposes of investigation to ascertain compliance with this [Contract] and rules, regulations and orders.

(G) In the event of the [Contractor's] failure to comply with the equal employment opportunity and affirmative action provisions of this [Contract], including the affirmative action undertaking outlined in it is [Proposal], or with any of the rules, regulations, or orders herein referred to, it is agreed that the [City], at its option, may do any or all of the following:

(1) Cancel, terminate, or suspend this [Contract], in whole or in part [...].

(2) Declare the [Contractor] ineligible for further [City Contracts].

(3) Recover from the [Contractor] by set-off against the unpaid portion of the [Contract], or otherwise pursuant to this [Contract], the sum of fifty dollars per [Day], as [Liquidated Damages] and not as a penalty, for each [Day] that the [Contractor] shall fail to comply with these provisions of the [Contract], as determined by the Human Relations Council in accordance with its rules and regulations, the said sum being fixed and agreed upon by and between the [Contractor] and the [City] because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages which the [City] would sustain in the event of such a breach of contract, and that amount is agreed to be the amount of damages which the [City] would sustain.

(4) Impose such other sanctions as may be imposed by the Human Relations Council pursuant to ordinances passed by the Commission, or seek such other remedies as may be provided by law.

(H) The [Contractor] shall include the provisions of this [Contract] in every subcontract, so that such provisions shall be binding upon each [Subcontractor]. The [Contractor] shall take such action with respect to any subcontracts as the Human Relations Council may direct as means of enforcing such provisions, including sanctions for noncompliance. However, in the event the [Contractor] becomes involved in, or is threatened with litigation with a [Subcontractor] as a result of such direction by the Human Relations Council, the [Contractor] may request the City to enter into such litigation to protect the interests of the City.

104.08 Notice of Commencement. The Authorized Representative shall prepare a Notice of Commencement in affidavit form identifying the name and address of the City, the Project, the name, address of the Contractor, the date of execution of the Contract, and the name and address of the Surety for the Contractor, in addition to the name and address of the Authorized Representative upon whom a Claim Affidavit may be served. The Notice of Commencement shall be made available upon request.

104.09 Giving Notice. Whenever any provision of the Contract Documents requires the giving of any notice after the execution of the Contract Form, such notice shall be deemed to have been validly given if delivered personally to the Person for whom the notice is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address of such Person known to the giver of the notice. All notices provided to the Contractor by the Engineer shall be copied to the Authorized Representative. All notices provided to the Engineer by the Contractor shall be copied to the Authorized Representative. All notices provided to the Authorized Representative by the Contractor shall be copied to the Engineer.

104.10 Computation of Time. When any period of time is referred to in the Contract Documents by Days, it shall be computed to exclude the first and include the last Day of such period. If the last Day of any such period falls on a Saturday, Sunday or a legal holiday, such day will be omitted from the computation and such period shall be deemed to end on the next succeeding day which is not a Saturday, Sunday or legal holiday.

104.11 Facsimile Transmission and Electronic Mail. Any notice required to be given by the Contract Documents may be given by facsimile transmission or electronic mail, provided the original signed notice is delivered within two Days after the date of the facsimile transmission or electronic mail. Facsimile transmittals in excess of 10 pages are discouraged.

104.12 Intent. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all. The Contractor shall provide all labor, Equipment and Materials necessary for the entire completion of the Work described in the Contract Documents and reasonably inferred therefrom to produce the intended results. The Specifications may not be superseded or amended by the Drawings

unless so provided in supplemental Specifications or Special Provisions prepared by the Engineer and approved in writing by the Authorized Representative. The Drawings shall generally govern dimensions, details and locations of the Work and calculated dimensions shall govern over scaled dimensions. The Specifications shall generally govern quality of Materials and workmanship. The organization of the Specifications in divisions, sections and articles, and the arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. In the event of inconsistencies within or between the Contract Documents, the Contractor shall provide the better quality or greater quantity of Work, and shall comply with the stricter requirement. Unless otherwise specified in the Contract Documents, words which have well-known technical or construction industry meanings are used in accordance with such recognized meanings.

104.13 Requests for Information. If the Contractor finds any perceived ambiguity, conflict, error, omission or discrepancy on or between any of the Contract Documents, including without limitation, the Drawings and Specifications, or between any of the Contract Documents and any applicable provision of law, the Contractor, before proceeding with the Work, shall submit a written Request for information to the Engineer for an interpretation or clarification. The Contractor shall be responsible for the prompt delivery of any such Request for information. The Engineer shall respond in writing to any and all requests for information within three business Days of receipt. Any interpretation or clarification of the Contract Documents made by any Person other than the Engineer, or in any manner other than in writing, shall not be binding and the Contractor shall not rely upon any such interpretation or clarification. If any change to the Work is made to accommodate unforeseen circumstances, the Engineer shall initiate the appropriate action and notify the Authorized Representative.

104.14 Ownership and Use of Drawings and Specifications. All Drawings and Specifications are the property of the City. In making copies of the Drawings and Specifications available, the City does not confer a license or grant permission for any use other than Work on the Project. Unless otherwise specified in the Contract Documents, the Engineer shall furnish to the Contractor, free of charge, 7 sets of Drawings and Specifications if the Contract price is five hundred thousand dollars or less, and 10 sets of Drawings and Specifications if the Contract price is in excess of five hundred thousand dollars. The Contractor may obtain additional copies of the Contract Documents from the Engineer, upon request, at the cost of reproduction, if any.

104.15 Access to Documents. The Contractor shall maintain in good order at the Project site one copy of all Drawings, Specifications, Bulletins, Addenda, approved Shop Drawings, catalog data, manufacturer operating and maintenance instructions, certificates, warranties, Change Orders, and other modifications, including As-built Drawings. The Contractor shall at all times permit access to the documents described in 104.15, and any other Contract Documents by the Authorized Representative and the Engineer.

104.16 As-Built Drawings. For Projects administered by the Water Engineering Manager of the City's Department of Water, or the Planning and Engineering Manager of the Department of Aviation, the Contractor shall keep an accurate record of all approved changes made to the Drawings to show Work as actually performed where such Work varies from Work as originally shown, including the exact location and depth of underground utility lines. During the performance of the Work, the Contractor shall record, prior to the submission of each Contractor

Payment Request, any approved changes on the Drawings, neatly in a contrasting color, noting new information not shown on the original Drawings. Failure to so record such changes may cause payment to be withheld or delayed. Where shop Drawings are used, the Contractor shall cross reference the corresponding sheet numbers on the Drawings and sections of the Specifications. The Contractor shall note related Change Order numbers where applicable. The Contractor shall keep a record of any change made to the Specifications, noting particularly any variation from manufacturer's instructions and recommendations. 104.16 shall not apply to any Project administered by the Engineer of the Department of Public Works unless required in the supplemental Specifications or Special Provisions for the Project.

104.17 Substitutes for Standards or Approved Equals. Requests for substitutes for standards or Approved Equals shall not be considered after the Bid Deadline unless listed on the Substitution sheet or after the Contractor can conclusively demonstrate to the Engineer one of the following conditions:

- (a) All applicable standards and Approved Equals are not available through no fault of the Contractor or the Contractor's Subcontractors and Material Suppliers;
- (b) All applicable standards and Approved Equals are no longer produced;
- (c) All applicable standards and Approved Equals will not perform as designed or intended.

104.18 Sales and Use Taxes. Only those Materials which ultimately become a part of the completed Structure or improvement which constitutes the Project will be exempt from State sales tax as provided in Section 5739.02 ORC, and State use tax as provided in Section 5741.01 ORC. The purchase, lease or rental of material, Equipment, parts or expendable items such as 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.

ITEM 105 CITY'S RIGHTS AND RESPONSIBILITIES

105.01 Generally

105.02 Right to Perform and Backcharge

105.03 Right to Partial Occupancy or Use

105.04 City's Right to File Suit

105.05 No Personal Liability of Public Officials

105.06 No Waiver of Legal Rights

105.07 No Estoppel

105.01 Generally. Information and services required of the City may be furnished through the Engineer or the Authorized Representative and shall be furnished in good faith and in a timely manner to avoid interference with, delay, hindrance, disruption or impact to the progress of the Project. The City and the City's officials, employees, consultants, agents and representatives as determined by the Engineer shall at all times have access to the Work whenever the Project is in preparation or progress. Upon the issuance of the Notice to Proceed or at a reasonable time thereafter, the City shall provide the Contractor the Project site in such condition to permit the Contractor to perform the Work. The foregoing are in addition to other rights and responsibilities of the City enumerated herein and especially those in respect to the City's right to prosecute the Work, approve payments and accept the Project.

105.02 Right to Perform and Backcharge. If the Contractor provides Defective Work or fails or neglects to perform the Work with the necessary diligence so as to complete the Work within the time specified in the Contract Documents or any portion of the Work by the applicable milestone completion date as set forth in the current Project, the Engineer shall notify the Contractor in writing of such failure or neglect. If such Defective Work, failure, or neglect results in a threat to the safety of any person or property, the Contractor shall immediately commence to correct such Defective Work, failure, or neglect upon receipt of written or oral notice thereof. Otherwise, if the Contractor fails or refuses to cure such Defective Work or failure or neglect within three business Days after receipt of the written notice or immediately in the case of a threat to any person or property, the Engineer shall recommend enforcement of the Contract to the City pursuant to 106.02 and 106.03. Without prejudice to any other remedy the City may have, the City may employ upon the Work the additional force, or supply the Materials or such part of either as is appropriate, to correct the deficiency in the Contractor's Work, as determined by the Authorized Representative. In all such cases of Defective Work, failure, or neglect, a Change Order shall be issued deducting from payments then or thereafter due the Contractor the costs arising out of or related to investigating and correcting such Defective Work, failure or neglect, including without limitation, the City's attorneys' and consultants' fees and Liquidated Damages. If the payments then or thereafter due the Contractor are not sufficient to cover such costs, the Contractor and the Contractor's Surety shall pay the amount of the insufficiency to the City. The decision of the Authorized Representative to backcharge the Contractor shall be final, subject to proceedings in accordance with 118.01 through 11

The City reserves the right to furnish at any time such Materials and labor and to prosecute such Work in addition to the Work of the Contractor as the City may desire; provided, however, that if such prosecution of additional Work should unreasonably interfere with, disrupt, hinder, delay or impact the Work of the Contractor, the Contractor shall be entitled to a reasonable extension of time in accordance with these Specifications.

105.03 Right to Partial Occupancy or Use. If the City finds it necessary to occupy or use the Project, or a designated portion of the Project prior to Contract Completion, such use may be accomplished if the Engineer informs the City that the portion in question has been approved for occupancy use, including by the Department of Building Services, if applicable. If Partial Occupancy or Use is approved by the City, the Engineer may process either a Change Order or a Certificate of Partial Occupancy or Use for the applicable portion of the Project listing the uncompleted or Defective Work under the Contract for approval by the City, provided that no such occupancy or use shall commence before any insurers providing property insurance have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. From the date of execution of the Change Order or Certificate of Partial Occupancy or Use by the Engineer, the Contractor shall be relieved of obligation to maintain the accepted portion of the Work, but shall remain obligated to correct any incomplete or Defective Work, including, without limitation any Punch List items then uncorrected. The Contractor shall continue to carry the appropriate insurance during performance of any such Work. Partial Occupancy or Use of the Project by the City shall not constitute acceptance of any Work not in conformity with the Contract Documents. Partial Occupancy or Use shall not relieve the Contractor of liability for any express or implied warranties or from responsibility for Defective Work.

105.04 City's Right to File Suit. The City may maintain an action in its own name for violations of any law relating to the Project, for any injury to Persons or property pertaining to the Work or for any other cause which is necessary in the performance of the City's duties.

105.05 No Personal Liability of Public Officials. In carrying out the provisions of the Contract Documents, or in exercising any power or authority granted to them by or within the scope of the Contract Documents, there shall be no liability upon the officers and employees of the City, whether personally or as officials of the City, it being understood that in all such matters they act solely as agents and representatives of the City.

105.06 No Waiver of Legal Rights. No action or omission by the City or the City's officers and employees, nor any approval of any request for payment, claim, or Change Order, nor any payment for or acceptance of any Work, nor any extension of time, nor any possession taken by the City or the City's officers or employees shall operate as a waiver of any provision of the Contract Documents, or of any power herein reserved to the City, or any right to damages herein provided; nor shall any waiver of any breach of the Contract be held to be a waiver of any other subsequent breach.

105.07 No Estoppel. The City shall not be precluded or estopped by any return or certificate given by the Contractor either before or after the final completion and acceptance of the Work from showing the true and correct amount and character of the Work done and Materials furnished, or from showing at any time that any such return or certificate is untrue and incorrect or improperly made, or from showing that the Work, Materials or Equipment do not conform to the Contract Documents or from demanding and recovering from the Contractor such damages as the City may sustain by reason of the Contractor's failure to comply with the Contract Documents.

ITEM 106 THE ENGINEER

106.01 Project Inspection

106.02 Rejection of Work

106.03 Contract Administration

106.04 Monitoring Progress

106.05 Interpretation

106.06 Authorization of Inspection, Testing and Approval

106.07 Review of Payment Requests

106.08 Review of Submittals

106.09 Preparation of Change Orders

106.10 Final Inspections

106.11 Claims Services

106.12 Project Rules and Hours

106.13 Construction Schedule

106.01 Project Inspection. The Engineer or Inspector shall inspect the progress and quality of the Work, including the preparation, fabrication or manufacture of Materials and Equipment, for conformity to the Contract Documents. The Engineer shall be provided access to all parts of the Project and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection. Inspection by the Engineer or an Inspector is solely for the benefit of the City and shall not relieve the Contractor of any of its responsibilities under the Contract Documents. When any unit of government, political subdivision or railroad corporation is to pay a portion of the cost of the Work, its representatives shall have the right to inspect the Work. Such inspection shall in no sense make any unit of government, political subdivision or railroad corporation a party to the Contract, and shall in no way interfere with the rights of the City or the Contractor under the Contract. The Inspector is not authorized to issue instructions contrary to the Contract Documents or to act for, or for the benefit of, the Contractor. Changes to the Contract Documents must be made in accordance with 117.01 through 117.12. No inspection performed pursuant to this Section shall constitute acceptance of the Work.

106.02 Rejection of Work. The Engineer or an Inspector shall have the authority to disapprove or reject any item of Work which is Defective, or that the Engineer or Inspector believes will not produce a Project that conforms to the Contract Documents, or that will prejudice the integrity of the design concept of the Project as a functioning whole as indicated by the Contract Documents. The Engineer or Inspector shall immediately notify the Authorized Representative and the Contractor at any time that Work has been disapproved or rejected. The Engineer or Inspector shall not be responsible for construction means, methods, manners, techniques, sequences, procedures, 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. No failure of the Engineer or Inspector to reject the Work shall constitute acceptance of the Work.

106.03 Contract Administration. The Engineer or his designee shall provide administration of the Contract for the Project as provided by the applicable agreement between the City and the Engineer, if any, and the Contract Documents. The Engineer shall attend any

and all progress and coordination meetings. The Engineer shall prepare a written report of each progress and coordination meeting and transmit it to the Authorized Representative within three business Days of the meeting. The Engineer shall not delegate the duty to prepare the written report of any Project and coordination meeting attended. The Engineer or Inspector may authorize minor changes or alterations in the Work not involving additional costs or time and not inconsistent with the overall intent of the Contract Documents but has no authority to authorize the Contractor to perform additional or extra Work for which the Contractor will seek compensation in addition to the Contract price or extension of the time for Contract Completion. The Engineer shall review and approve, or recommend approval, of all forms required under the Contract Documents. The Engineer shall render decisions in connection with the Contractor's responsibilities under the Contract Documents and submit recommendations to the Authorized Representative for enforcement of the Contract as necessary.

106.04 Monitoring Progress. The Engineer shall monitor the progress of the Work for conformance with the Construction Schedule and shall initiate revisions of the Construction Schedule as required by the Contract Documents. In the event of default by the Contractor, the Engineer may pursue the Contractor's Surety to Contract Completion. The Engineer shall keep a daily log containing a record of weather, number of workers on site, identification of Equipment, Work accomplished, problems encountered, and other similar relevant data.

106.05 Interpretation. The Engineer will be the initial interpreter of all requirements of the Contract Documents. All decisions of the Engineer shall be subject to final determination by the City. Contractor acknowledges that Engineer, within its limited agency for the City, may consult with the City's legal counsel and that all such consultation and communications are privileged.

106.06 Authorization of Inspection, Testing and Approval. The Engineer shall authorize special inspection, testing or approval of the Work, as provided in 107.31, whenever in the Engineer's reasonable opinion such action is necessary or advisable to insure conformity with the Contract Documents.

106.07 Review of Payment Requests. Based upon the Engineer's on-site observations and evaluation of the Contractor's Payment Request, the Engineer shall review and certify the amounts due the Contractor. The Authorized Representative may recommend to the City that payment be withheld from, or Liquidated Damages be assessed against, a Contractor's Payment Request, stating the reasons for such recommendation. The Engineer's certification for payment shall constitute a representation to the City that the Work has progressed to the point indicated and that, to the best of the Engineer's knowledge, information and belief, the Work is in conformity with the Contract Documents and the Contractor is entitled to payment in the amount certified.

106.08 Review of Submittals. The Engineer shall review and approve or take other appropriate action upon the Contractor's submittals within the required time for the purpose of checking for conformity with the Contract Documents. Such review and approval shall not relieve Contractor of its duty to strictly conform to the Contract Documents.

106.09 Preparation of Change Orders. The Engineer shall prepare all Bulletins and Change Orders, including a cost estimate and supporting documentation and data. Once executed, a Change Order shall constitute the full and complete satisfaction for all claims of all direct and indirect costs, overhead costs of all kinds, inefficiency costs, acceleration costs, the cumulative impact of the Change Order and other Change Orders executed prior to it, the impact of the Change Order on unchanged work and interest related thereto, which has been or may be incurred by Contractor in conjunction with the change in scope and/or project extension set forth in the Change Order.

106.10 Final Inspections. The Engineer shall conduct inspections to determine the date of Contract Completion and shall receive, review and forward to the appropriate Person all Project record submittals required by the Contract Documents. Such inspection shall not constitute acceptance of the Work, nor shall it relieve Contractor from its duty to correct defective or non-confirming work not noted during the inspection.

106.11 Claims Services. The Engineer shall render analyses, written recommendations, or decisions, within the time specified, on all claims, disputes, or other matters in question between the Contractor and the City and shall provide information or services to the City until final disposition of all such claims, disputes, and matters. If Engineer does not approve a Contractor claim or fails to act within the required time, Contractor's claim shall be considered to be denied.

106.12 Project Rules and Hours. The Engineer shall consult with the Authorized Representative to obtain full knowledge of all City rules, regulations or requirements affecting the Project. The Engineer shall establish the regular working hours with the Contractors, subject to approval of the Engineer.

106.13 Construction Schedule. The Engineer shall review the Construction Schedule together with a schedule of submittals which is coordinated with the Construction Schedule in accordance with 109.05 through 109.09. If the Contractor fails to prosecute the Work in accordance with the Construction Schedule, the provisions of 105.02 may be invoked.

ITEM 107 THE CONTRACTOR

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107.01 Construction Procedures. The Contractor shall be responsible for and have control over all construction means, methods, manners, techniques, sequences and procedures for all portions of the Contractor's Work and shall be responsible for any injury or damage which may result from the Contractor's Work or from improper construction, installation, maintenance or operation to the fullest extent permitted by law. Unless otherwise specified in the Contract Documents, the Contractor shall be responsible for properly and accurately laying out all lines, levels, elevations, grades and measurements for all the Work required by the Contract Documents and for the preservation of all related stakes and markers.

107.02 Cutting, Fitting and Patching. The Contractor shall do any cutting, fitting or patching required for the Contractor's Work and shall not endanger the Project by cutting, excavating or otherwise altering the Project, or any part of it. If Contractor requires sleeves, the Contractor shall furnish and coordinate the installation of the sleeves. The Contractor shall be responsible for the exact location and size of all holes and openings required to be formed or built for the Work, to permit coordination with any Work performed by other Persons on the Project. The Contractor shall allow sufficient time for installation of any Work performed by other Persons before covering or closing the applicable portion of the Project. Patching shall match and blend with the existing or adjacent surface. Any patching required because of Defective or ill-timed Work shall be done by and at the expense of the Contractor.

107.03 Excavation. The Contractor shall not cut away any Structure or dig under any foundation or into any wall, or any other part of the Project, without the written approval of the Engineer. Unless otherwise specified in the Contract Documents, the Contractor, prior to starting excavation or trenching, shall give notice at least two business Days in advance to the Owners of underground utilities registered with the Ohio Underground Utility Protection Services (OUPS) at www.oups.org, or by phone at (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 forty-eight hours of notice, excluding Saturdays, Sundays and legal holidays, to stake, mark or otherwise designate the location of its utilities in the construction area together with its approximate depth. If any underground utility Owner fails to timely perform, the Contractor shall immediately notify the Engineer and contact the Owner of the underground utility. If any underground utility must be moved or adjusted, the Contractor shall notify the Owner of the underground utility in a timely manner so that the Work will not be delayed. Unless otherwise provided in the Contract Documents, any movement or adjustment of any underground utility or utility appurtenances, including without limitation electrical and gas meters, water and gas valves and light standards within the Project site is made by the Owner of the utility at the utility Owner's expense. In performing any excavation or trenching, the Contractor shall exercise caution and implement appropriate safety precautions to avoid property damage and personal injury. The Contractor shall backfill any excavation with the material specified and approved by the Engineer. The right to construct or reconstruct any utility service in the street or right of way or to grant permits for same, at any time, is hereby expressly reserved to the City and the Contractor shall not be entitled to any damages for the digging up of the street or Right-of-Way in accordance with such a permit. Any Person wishing to make an opening in the street must secure a permit from the City. The Contractor shall allow Persons bearing such permits, and only those Persons, to make openings in the street or Right-of-Way. When required by the Engineer, the Contractor shall make all necessary repairs due to such openings under the same conditions as the Work. Any adjustment of the Contract price or of the time for Contract Completion resulting from any such opening or repair may be made by Change Order. When the Work includes construction of underground lines and Structures, the Contractor shall make temporary restoration of street surfaces immediately upon completion of the underground lines and Structures, shall remove surplus excavated Materials and shall grade the street and put it into a safe and passable condition. The Contractor shall immediately refill any settlement in or adjacent to trenches for such construction to the proper grade.

107.04 Borrow and Waste Areas. A Change Order may be issued in accordance with 117.01 to 117.12 to permit the Contractor to use natural Materials found on the site of the Project.

Whenever Materials are to be borrowed or wasted in borrow or Waste Areas or, if allowed by the Contract Documents, wasted on the Project site, the Contractor shall prior to beginning borrow or wasting operations, obtain the Engineer's written approval of a detailed operation plan that addresses the following concerns:

- (a) Control of drainage water;
- (b) Cleanup, shaping, and restoration of disturbed areas;
- (c) Disposal of regulated Materials;
- (d) Avoidance of regulated areas;
- (e) Excavation and filling of waste and Borrow Areas;
- (f) Saving of topsoil;
- (g) Measures to minimize sediment runoff, including keeping sediment and other contaminants from leaving the Project site and from entering streams, lakes, or reservoirs by using methods provided in the Contract Documents.

The Contractor shall use the current versions of ODOT's *Sediment and Erosion Control Handbook* and the *Location and Design Manual, Volume 2, Drainage Design* to design and plot a sedimentation and erosion control plan on Project plan sheets and ensure the plan complies with all current provisions of ORC, Chapter 6111 and the NPDES permit. The Contractor shall not waste material and discharge dredge or fill Materials into the "Waters of the United States" or an isolated wetland without the required permits from U.S. Army Corps of Engineers (404 Permit) and the Ohio EPA (401 Permit). The Contractor shall have the proposed borrow and Waste Areas reviewed by a qualified environmental consultant approved by the City and have the environmental consultant certify that the proposed borrow and waste operations will not impact the "Waters of the United States" or an isolated wetland. If consultant certification is not provided, the Contractor shall obtain the 404/401 Permits necessary to perform the operations as proposed and have the environmental consultant certify that the Work conforms to the requirements of the permits. The Contractor shall provide copies of all documentation submitted to obtain the appropriate permits and copies of the permits to the Engineer. The Contractor shall not waste or borrow material from a cultural resource site or a site eligible for the national Register of Historic Places. For sites found to have historic or prehistoric human remains, the Contractor shall comply with the requirements of Sections 2909.05 and 2927.11, ORC. If the Contract Documents require a cultural resource investigation, a qualified environmental consultant approved by the City for cultural resource investigation shall be used to review and certify that the waste or Borrow Area:

- (a) does not impact a cultural resource;
- (b) is not a cultural resource;
- (c) is not eligible for the national Register of Historic Places; or
- (d) does not consist of historic or prehistoric human remains.

If burning is permitted under the OAC-3745-19 and Section 1503.18, ORC, the Contractor shall submit a copy of the Ohio EPA permit and the Ohio DNR permit to the Engineer and copies

of all information used to obtain the permit. All damage to surrounding property resulting from the instability of borrow and Waste Areas, the removal of borrow Materials, the placement of waste Materials, or the hauling of material to and from these areas is the sole responsibility of the Contractor. Prior to the disposal of waste Materials outside the Project site, the Contractor shall submit to the City an executed copy of the Contract or permission statement from the property Owner. The Contract or permission statement must indicate that the waste Materials are not the property of the City, that the City is not a party to the Contract or permission statement and that the Contractor and property Owner will hold the City harmless from claims that may arise from their Contract or permission statement. Restoration of all borrow and Waste Areas includes cleanup, shaping, replacement of topsoil, and establishment of vegetative cover by seeding and mulching according to the Contract Documents. The Contractor shall ensure that the restored area is well drained unless approval is given by the Engineer to convert a pit area into a pond or lake, in which case the Contractor shall confine restoration measures to the disturbed areas above the anticipated normal water level, and that any proposed waste location is not within the FEMA mapped one hundred year floodplain. If the proposed waste location is within the FEMA mapped one hundred year flood plain, the Contractor shall submit written approval from the local floodplain coordinator for the site. The floodplain coordinator contacts for each county are available through the Ohio DNR, Division of Water, (614) 265-6750. No extension of time or additional compensation will be paid for any delays due to not having the written permit(s) to waste in a floodplain.

107.05 Construction and Demolition Debris. OAC-3745-37, OAC-3745-400, and Chapter 3714 ORC, regulate the use and disposal of construction and demolition debris. The Contractor shall notify the local Board of Health or the local Ohio EPA office seven Days before placing clean hard fill off the Project site or Right-of-Way and submit copies of this notification to the Engineer. The Contractor shall dispose of debris containing wood, road metal, or plaster at a licensed construction and demolition debris site. The disposal of brush, trees, stumps, tree trimmings, branches, weeds, leaves, grass, shrubbery, yard trimmings, crop residue, and other plant matter is restricted. If allowed by the Contract Documents, the Contractor may waste brush, trees, stumps, tree trimming, branches, weeds, leaves, grass, shrubbery, yard trimmings, crop residue, and other plant matter within the Project site or the Right-of-Way. Otherwise, the Contractor shall submit a plan and any required permits to legally dispose of these Materials off the Project site or Right-of-Way to the Engineer and shall provide all documents submitted to obtain this permit to the Engineer. If the Project contains garbage or solid and hazardous waste, the Contractor shall comply with applicable laws and any applicable provisions of the Contract document for the removal of these items. When wasting PCC, the Contractor shall mix the PCC with at least thirty percent natural soil to construct an inner core in the Waste Area, cover this inner core with 3 feet of natural soil on the top and eight feet on the side slopes and place and compact the material according to the Contract Documents to prevent future settlement and sliding.

107.06 Manufacturer's Recommendations. The Contractor shall install all Work in accordance with the Contract Documents and any recommendations of the manufacturer, including required temperature and humidity for installation of the various Materials.

107.07 Construction Supervision. The Contractor shall provide continuous supervision at the Project by a competent Superintendent when any Work is being performed, unless waived by the Authorized Representative. The Superintendent shall have responsibility and authority to

act on behalf of the Contractor. All communications to the Superintendent shall be as binding as if given directly to the Contractor. The Contractor shall submit an outline of the qualifications and experience of the Contractor's proposed Superintendent, including references, to the Engineer within ten Days of the Notice to Proceed. The City reserves the right to reject the Contractor's proposed Superintendent. Any such rejection shall be determined by the Authorized Representative. Failure of the Authorized Representative to notify the Contractor of such rejection within thirty Days of receipt of the required information shall constitute notice that the City has no objection. If the City rejects the Contractor's proposed Superintendent, the Contractor shall replace the Superintendent at no additional cost to the City. The Contractor shall not change or terminate the Superintendent without written approval of the Authorized Representative. If the Contractor proposes to change or terminate the Superintendent, the Contractor shall submit to the Engineer a written justification for the change or termination, along with the name and an outline of qualifications experience of the Contractor's proposed new Superintendent, not less than ten Days prior to any change or termination. The procedure provided above shall be applied to evaluate the Contractor's proposed new Superintendent. If in the City's sole discretion, the performance of the Superintendent is unsatisfactory at any time, the City may require that Contractor replace such Superintendent with a Superintendent satisfactory to the City at no additional cost to the City.

107.08 Protection of Project, Property and Utilities. The Contractor shall protect the Work from weather, and shall maintain the Work and all Materials, including Materials delivered to the Contractor by the City, apparatus, fixtures and other items on or adjacent to the Project site free from injury or damage until Final Acceptance. Non-rubber tired vehicles or Equipment shall not be moved on City streets and off road vehicles shall not be used on bases or pavements without the written approval of the Engineer. Work or items likely to be damaged shall be covered or protected at all times to prevent damage. Any Work or item damaged by failure of the Contractor to provide coverage or protection shall be removed and replaced with new Work or a new item, as applicable, at the Contractor's expense. The Contractor shall perform the Work within the site of the Project and any applicable easement or Right-of-Way. Any adjacent property, including without limitation roads, walks, shrubbery, plants, trees or turf, damaged during the Contractor's Work shall be properly repaired or replaced at the Contractor's expense. Unless otherwise specified in the Contract Documents, the Contractor shall protect the Project and existing or adjacent property and utilities from damage at all times and shall erect and maintain necessary barriers, furnish and keep lighted necessary danger signals at night, and take precautions to prevent injury or damage to individuals or property. When mailboxes, road or street name signs and supports are within the Project site, the Contractor shall remove and erect them in a temporary location during construction in a manner satisfactory to the Engineer. After completion of the Work, the Contractor shall erect the mailboxes, road or street name signs and supports in a permanent location in accordance with the Drawings unless otherwise required by Change Order. Removal, temporary erection and permanent erection shall be in accordance with United States postal regulations. When cornerstones, monuments and property corner pins are encountered in the performance of the Work, and monument covers are not listed in the Bid, the City will supply them and supervise their precise location and installation, and the Contractor will furnish all the labor, Materials and Equipment required for such installations. 105.02 may be invoked for the cost to the City for repair, re-evaluation of location and replacement of any cornerstone, monument or property corner pin within the Project, damaged, destroyed or made inaccessible during the progress of the Work by the Contractor. Existing surface or overhead Structures or utility lines are not necessarily shown on the Drawings and the locations of those shown are approximations. The Contractor shall make such investigations as are necessary to determine the extent to which existing surface or overhead Structures may interfere with the

performance of the Work. Any sizes, locations, and depths for such Structures are approximations and the Contractor shall make such investigation or exploration as may be necessary to determine the actual sizes, locations and depths. The Contractor shall field locate all existing utilities before setting line and grade. Unless otherwise specified in the Contract Documents, the Contractor shall remove all snow and ice as may be required for access to and performance of the Work.

107.09 Load Restrictions. The Contractor shall not load, nor permit any part of the Project to be loaded, in any manner that will endanger the Project, or any portion thereof, nor shall the Contractor subject any part of the Project or existing or adjacent property to stress or pressure that will endanger the Project or property. The Contractor shall provide all temporary bracing, shoring and other structural support required for safety of the Project and proper execution of the Work, including without limitation all necessary support and protection of the property of any utility. The Contractor shall comply with all legal load restrictions in the hauling of Materials on public roads and shall operate Equipment of a weight or so loaded as to not cause damage to Structures, Roadway, or other construction. A special permit will not relieve the Contractor of sole liability for damage which may result from the moving of Equipment or Materials. The Contractor shall not haul on concrete pavement, base or Structures before the expiration of the curing period.

107.10 Materials and Equipment. The Contractor shall provide only new Materials and Equipment of the quality specified in the Contract Documents. The Contractor shall immediately remove Materials or Equipment not conforming to the requirements of the Contract Documents. The Contractor shall not incorporate Materials or Equipment, the defects of which have been corrected without written approval from the Engineer. If the City is to furnish any Materials, the City shall deliver them in accordance with the Contract Documents. The Contractor shall coordinate and schedule sufficient time for any such delivery. The Contractor shall provide domestically produced steel as required by law including Sections 153.011 and 5525.21, ORC, and Federal laws and regulations, if applicable. The Contractor shall furnish documentation to the Engineer evidencing the domestic origin of applicable steel and iron products before they are incorporated into the Project. Steel and iron products without a traceable, documented domestic origin will be treated as non-domestic products. The City may reject any item or material provided by a Contractor in violation of this requirement. The Contractor shall notify the Engineer of proposed sources of Materials prior to delivery. The Engineer may approve Materials at the source of supply before delivery. If the proposed source of supply cannot produce the specified Materials, the Contractor shall furnish Materials from Alternate sources without adjustment of the Contract price or the time for Contract Completion.

107.11 Storage. Only the material and Equipment which are to be used directly in the Work shall be brought to or stored at the Project by the Contractor and the Contractor's Subcontractors and Material Suppliers. The Contractor shall be responsible for the proper handling and storage of all material and Equipment brought or delivered to the Project to assure preservation of their quality and fitness for the Project and to facilitate inspection of them. Aggregates shall be transported from any storage site to the Project in tight vehicles so constructed as to prevent loss or segregation of Materials after loading and measuring in order that there may be no inconsistencies in the quantities of Materials intended for incorporation in the Project as loaded, and the quantities as actually received at the site of the Project. After any material or Equipment is no longer required for the Work, the Contractor shall promptly remove

such material and Equipment from the Project. The Contractor's Materials and Equipment shall not be stored in any Right-of-Way unless the location of such storage is approved by the Engineer. The Contractor shall, before storing Materials in gutters, lay suitable drains of sufficient size to carry all the storm water flowing in such gutters. Where the drainage from cross streets or alleys is interfered with or cut off by reason of the nature of the Work, the Contractor shall provide suitable crossings for pedestrians. No material or Equipment shall be stored within 20 feet of any fire hydrant. Private property shall not be used for storage of material and Equipment without the prior written permission of the Owner or lessee of the private property, and if requested by the Engineer, the Contractor shall provide a copy of the written permission to the Engineer. The Contractor shall restore all storage sites to their original conditions. The Contractor's material and Equipment shall not cause damage to the Project or adjacent property and shall not endanger any individual at, or in the vicinity of, the Project. Any injury to any individual or damage to property resulting from the Contractor's material or Equipment shall be the responsibility of the Contractor.

107.12 Labor. The Contractor shall maintain a sufficient workforce to timely perform the Work and enforce good discipline and order among the Contractor's employees and the employees of the Contractor's Subcontractors and Material Suppliers. The Contractor shall not permit employment of individuals not skilled in tasks assigned to them. The Contractor shall dismiss from the Project any individual employed by the Contractor or the Contractor's Subcontractors and Material Suppliers who is found by the Authorized Representative, pursuant to a recommendation from the Engineer, to be incompetent, guilty of misconduct, or detrimental to the Project. 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.

107.13 Maintenance of Utilities. The Contractor shall at all times provide and maintain access to fire hydrants, water valves, water service boxes, gas valves, gas service boxes, manholes and other similar appurtenances. During the course of construction, the Contractor shall be solely responsible to notify any utility or other service when such utility or service is encountered. The Contractor shall protect all above ground utilities, Structures and appurtenances and shall replace any damaged portions thereof. The Contractor shall protect all below ground utilities, Structures and appurtenances that may be accurately located by removing manhole covers, valve box covers, and other access point coverings with reasonable effort using hand tools for such removal and shall replace any damaged portions thereof.

107.14 Maintenance of Traffic. Vehicular and pedestrian public traffic shall be maintained during the Project whether it is traffic through the Project or only cross traffic at intersections, unless otherwise provided in the Contract Documents. The Contractor shall make all repairs to roads necessary to maintain traffic to the satisfaction of the Engineer. If there are locations on the Project where Sewer or water line construction only is called for and a part of the existing pavement will remain in place, traffic shall be maintained and ingress and egress to all public and private entrances shall be provided. The Contractor shall provide all necessary flaggers. The Contractor shall provide and maintain access to adjacent property including by constructing necessary temporary walks, driveways, Bridges, crossings, and Roadways. The Contractor shall notify the applicable fire and police department whenever a street or alley, or a portion of a street or alley is about to be closed to traffic and shall provide notice when such street or alley or portion thereof is to be opened. In the event of the complete closure of any street,

alley or private drive, the City shall give notification to the occupants of all premises affected by the closure. The Contractor shall promptly notify the Engineer of all unforeseen effects of the Project on traffic. Unless the Contract Documents provide otherwise, all traffic control devices shall be furnished, erected, maintained and removed by the Contractor in accordance with the OMUTCD.

107.15 Safety Precautions. The Contractor shall take reasonable, diligent precautions and shall be responsible for the safety of individuals on or adjacent to the Project and shall comply with all applicable provisions of federal, State and municipal safety laws, regulations, and building codes to prevent injury to individuals on or adjacent to the Project. The Contractor shall comply with the rules, regulations and orders of OSHA. The Contractor shall be responsible for any fine or cost incurred as a result of any violation or alleged violation of such rules, regulations or orders. The Contractor shall take reasonable, diligent precautions and shall be responsible for the safety of the Project, including without limitations all Materials and Equipment incorporated or to be incorporated in the Project. Prior to the start of any Work, the Engineer shall meet with the Contractor and other applicable Person to coordinate the Contractor's methods and Equipment for protecting the Project, other property and individuals from damage or injury, in accordance with applicable regulations. The Engineer efforts at coordination shall not relieve the Contractor of any responsibility for safety or ensure the Engineer to become responsible for safety. Methods and Equipment for protecting the Project, other property and individuals shall be subject to inspection and approval of the appropriate authority having jurisdiction over the Project site.

107.16 Work Stoppage Due to Hazardous Materials. In the event the Contractor, except a licensed abatement Contractor, encounters Materials reasonably believed to contain asbestos, polychlorinated biphenyl (PCB) or other hazardous waste or material, which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Authorized Representative and the Engineer in writing. A licensed abatement Contractor shall report the condition to the Authorized Representative and the Engineer in writing and shall remove the waste or material or render it harmless. The Work in the affected area shall be resumed upon written notice from the Engineer that the waste or material has been removed or rendered harmless. The term "rendered harmless" shall mean that the level of exposure is less than any applicable exposure standards set forth by OSHA or other applicable regulations. Hazardous Materials to be used at the Project shall be identified by a MSDS. The applicable MSDS shall be prepared by the Contractor and submitted to the Engineer prior to a hazardous material being brought to the Project site. The Contractor shall maintain all applicable MSDS on site whenever Work is in preparation or progress.

107.17 Vehicle Damage Claims. When a Person reports damage to a vehicle, whether orally or in writing, to the Contractor, the Contractor shall file a written report, including copies of applicable police reports, with the Authorized Representative within three Days.

107.18 Fire Hydrants. The Contractor shall make any necessary arrangements with the City Department of Water for any use of fire hydrants in connection with the Work and shall pay for all water used from the hydrants. Permits from the Department of Water for use of fire hydrants shall be provided to the Engineer upon request.

107.19 Engineer Facilities. Unless otherwise specified in the Contract Documents, the Contractor shall provide and maintain in a clean condition the following temporary facilities, Equipment and services for use by the Engineer:

- (a) If space is available near the Project, 2 separate office spaces, both of which shall be adequately heated, lighted, air conditioned, and with doors which lock, the keys to which shall be provided to the Engineer;
- (b) If space is not available near the Project, a standard width job trailer shall be provided, which shall be adequately heated, lighted, air conditioned, and with doors which lock, the keys to which shall be provided to the Engineer;
- (c) Each office space shall be equipped with at least 1 desk, 1 desk chair and 2 side chairs and reasonable circulation space;
- (d) Each office space shall have 1 four-drawer filing cabinet or equivalent;
- (e) A plan rack and 4 by 8 foot plan table shall be provided in 1 office space;
- (f) Each office space shall have at least 1 telephone in service;
- (g) Use of a facsimile and copy machine shall be provided for use either in one of the office spaces or in an adjacent office space;
- (h) One office space shall have a computer to the City's criteria with electronic mail capabilities.

107.20 Meeting Spaces. Unless otherwise specified in the Contract Documents, the Contractor shall provide adequate space, Equipment and furnishings to conduct progress and coordination meetings for the Project. The meeting area shall be furnished with an appropriate meeting table and an appropriate number of folding or stacking chairs to adequately seat all participants at the meetings.

107.21 Temporary Heat. Unless otherwise specified in the Contract Documents, the Contractor shall provide temporary heat necessary so that the Work shall proceed expeditiously during inclement weather, and to protect the Contractor's Work and Materials from damage. From a date of partial occupancy, the City is responsible for the cost of providing heat for the occupied portion of the Project.

107.22 Water. Unless otherwise specified in the Contract Documents, the Contractor shall provide all water necessary for the Contractor's Work. From a date of partial occupancy, the City is responsible for the cost of water consumed for the occupied portion of the Project.

107.23 Hoists and Elevators. The Contractor shall provide and maintain adequate hoisting and elevator facilities as required for the Contractor's Work in coordination with the Engineer. If electric service requirements of hoisting or elevator facilities differ from that available at the Project site, the Contractor requiring use of such hoisting or elevator facilities shall make

and pay for all necessary connections. Unless otherwise specified in the Contract Documents, the Contractor requiring use of hoisting or elevator facilities, after the Project is enclosed, shall be responsible for transporting individuals and Materials as required for the Contractor's Work.

107.24 Electricity. Unless otherwise specified in the Contract Documents, the Contractor shall make all arrangements for temporary light and power services and shall pay all charges, both for service installation and removal, if required, and for energy consumed until Final Acceptance of the Project. Unless otherwise specified in the Contract Documents, the Contractor requiring any electrical service requirements relating to temporary hoists, cranes, welding Equipment or elevators shall subcontract with a licensed Contractor for such service requirements and shall be responsible for all costs of such services. From a date of partial occupancy, the City is responsible for the cost of energy consumed for the occupied portion of the Project.

107.25 Temporary Facilities. Unless otherwise specified in the Contract Documents, the Contractor shall provide, and maintain in a clean condition, adequate and approved sanitary facilities for use by all Persons at the Project in coordination with the Engineer.

107.26 Drainage. The Contractor shall be responsible for all temporary drainage necessary for the Contractor's Work and shall employ pumps, trenches, drains, sumps or other necessary elements as required to afford satisfactory working conditions for the protection, execution and completion of the Project.

107.27 Environmental Protection. The Contractor shall comply with all applicable federal, State and local laws and regulations relating to pollution of the environment and shall take precautions to prevent pollution of water with fuels, oils, bitumens, calcium chloride, sediments and other Materials. When the work area is located in or adjacent to streams and other watercourses, the area shall be separated from the main stream by a dike or barrier to keep sediment from entering the stream. The Contractor shall take care during the construction and removal of such barriers to minimize siltation of the stream and watercourse. Control of ground water and water in excavations shall be accomplished in a manner that will prevent degradation of the quality of any surface water. Wells and well points shall be installed with suitable screens and filters where necessary to prevent the continuous pumping of fines. The discharge of sediment laden water from pumping shall be performed in a manner to prevent degradation of streams, watercourses, lakes, ponds, or other areas of water impoundment. Such prevention may require, without limitation, the use of ditch check dams, sediment traps, sediment basins, sediment pits, filters, filtration bags or other control devices and methods necessary to prevent adverse effects to surface waters as provided in Chapter 3745-1-04 OAC. The cost of constructing and maintaining these measures shall be borne by the Contractor. Water from aggregate washing or other operations containing sediment shall be treated by filtration, settling basins or other measures sufficient to reduce the sediment concentration to not more than that of the stream, watercourse, lake, pond or the area of water impoundment. The Contractor shall not cause or permit the handling or transporting or storage of any material in a manner which allows or may allow unnecessary amounts of particulate matter to become airborne or cause or permit the Project to be constructed, used, repaired or demolished without applying all such reasonable measures as may be required to prevent particulate matter from becoming airborne. The Engineer may require necessary measures to prevent particulate matter from becoming airborne including without limitation the paving or frequent cleaning of roads, driveways and parking lots,

the application of dust-free surfaces, the application of water and the planting and maintenance of vegetative ground cover. When dust, fumes, gases, mist, odorous matter, vapors, or any combination thereof escape from the Project or Equipment in such manner and amount as to cause a nuisance or to violate any regulation, the Engineer may require that the Project or Equipment in which processing, handling and storage are done be tightly closed and ventilated in such a way that all air and gases and air or gas-borne material leaving the Project or Equipment are treated by removal or destruction of air contaminants be discharged to the open air.

107.28 NPDES General Permit. The Contractor shall secure any required NPDES general permit by submitting a notice of intent application form to the Ohio EPA at least forty-five Days prior to the start of construction. When required by law, the Contractor shall prepare and certify a storm water pollution prevention plan and process the required notice of termination prior to completion of the Project. The Contractor shall comply with all requirements and conditions of any NPDES general permit, including, but not limited to, implementing and maintaining the control measures specified in the storm water pollution prevention plan, maintaining records of construction activities, and removing Materials no longer required and taking proper action if there is a reportable quantity spill.

107.29 Building Permits. Unless otherwise specified in the Contract Documents, the Contractor shall secure the required general building permits. The Contractor shall schedule and attend all intermediate and Final Inspections required for any permit certification. The Contractor shall schedule inspection for occupancy permits with the appropriate local fire authority and State Fire Marshal. The Contractor shall give the Engineer and the Authorized Representative reasonable notice of the date arranged for any inspection.

107.30 Other Permits. Unless otherwise specified in the Contract Documents, the Contractor shall apply for, secure and pay the fees for any permit, license or tap in required by State or local authorities having jurisdiction over the Project, except the NPDES permit and the general building permits secured by the Engineer in accordance with 107.29. The Contractor shall give the Engineer and the Authorized Representative reasonable notice of the date arranged for any related inspection.

107.31 Inspection, Testing and Approval. Unless otherwise specified in the Contract Documents, the Contractor shall apply for, secure and pay for any inspection, testing or approval required by the Contract Documents, laws, ordinance, rules, regulations or orders of any public authority having jurisdiction over the Project. The Contractor shall give the Engineer and the Authorized Representative reasonable notice of the date arranged for such inspection, testing or approval. The Contractor shall provide an original report of the inspection, testing or approval to the Engineer for approval. If, after the commencement of the Work, the Engineer determines that any portion of the Work requires special inspection, testing or approval, in addition to any inspection, testing or approval provided for or required by the Contract Documents, in order to insure conformance to the Contract Documents, the Engineer may instruct the Contractor in writing to order such special inspection, testing, or approval, or the Engineer may make the arrangements for same. If such special inspection, testing or approval reveals a failure of the Work to comply with the requirements of the Contract Documents, the Contractor shall pay all costs associated with such special inspection, testing or approval. If such special inspection, testing or approval reveals that the Work is in compliance with the Contract Documents, the

Contractor will be paid, by appropriate Change Order, for all costs associated with such special inspection, testing or approval. Neither the observations of the Engineer in the administration of the Contract, nor any inspections, tests or approvals by Persons other than the Contractor shall relieve the Contractor from the Contractor's obligation to perform the Work in conformity with the Contract Documents.

107.32 Uncovering the Work. If any Work is covered contrary to the requirements of the Contract Documents or contrary to the written request of the Engineer, such Work must, if required by the Engineer in writing, be uncovered for observation and replaced, if not in conformity with the Contract Documents, and recovered at the Contractor's expense. If any Work has been covered in accordance with the Contract Documents and is Work which the Engineer had not requested the opportunity to observe prior to covering, the Engineer may request that such Work be uncovered by the Contractor. If such Work is found not to be in conformity with the Contract Documents, the Contractor shall pay all costs of uncovering, correcting, replacing, and recovering the Work. If such Work is found to be in conformity with the Contract Documents, a Change Order will be processed to pay the Contractor for the cost of uncovering, correcting, replacing, and recovering the Work, subject to final approval by the City Commission.

107.33 Correction of the Work. The Engineer shall notify the Contractor in writing if any Work is found by the Engineer to be Defective, whether observed before or after Contract Completion. The Engineer shall specify in the written notice the time within which the Contractor shall correct the Defective Work. The Contractor shall bear all costs of correcting such Defective Work, including the cost of any consequential damages. If the Contractor fails to correct any Defective Work within the time fixed in the written notice, the City may correct such Work and obtain recovery of all costs, including without limitation any consequential damages, and all attorneys' and consultants' fees, from the Contractor or the Contractor's Surety.

107.34 Interruption of Existing Services. Whenever it becomes necessary to interrupt existing services in use by the City or its residents, such as Sewer, water, gas, and steam lines, electric or telephone and cable service, the Contractor shall continue the Work on a non-stop twenty-four hour per Day basis until the Work is completed and the service restored, or at such Alternate time required by the Authorized Representative. Before beginning such Work, the Contractor shall apply in writing to and receive approval in writing from the Authorized Representative and the Person with appropriate jurisdiction over the Project, to establish a time when interruption of the service will cause a minimum of interference with the activities of the City, its tenants, if any, and the public.

107.35 Clean Up. During the progress of the Work, the Contractor shall be responsible for the removal and off-site disposal of all waste, excess Materials and rubbish, including without limitation layout stakes, sediment control devices and temporary Structures, attributable to the Work to an appropriate disposal site. Temporary on-site storage of waste, excess Materials and rubbish may be permitted as designated by the Engineer. Unless otherwise provided in the Contract Documents, the Contractor shall perform daily broom cleaning in the area of the Contractor's Work and shall, at the end of each working Day or upon notice from the Engineer, remove all waste Materials and rubbish from the Project. The Contractor shall, as required for the Project or upon notice from the Engineer, clean and remove any waste Materials or rubbish from areas adjacent to the Project. The Contractor shall, as required for the Project or upon

notice from the Engineer, take all necessary actions to minimize and clean dust and mud from the Project and adjacent property in accordance with City ordinances and regulations. If the Contractor fails to clean up during the progress of the Work, the provisions of 105.02 may be invoked. If the Contractor fails to maintain the areas adjacent to the Project clean and free of dust, mud, waste, excess Materials and rubbish, upon written notice from the Engineer, the Authorized Representative shall direct the local jurisdiction having responsibility for the area to clean the area or shall employ City employees or another Person to clean the area. The cost of cleaning the area adjacent to the Project shall be deducted from the Contractor as the Engineer recommends and the Authorized Representative determines to be appropriate. The decision of the Authorized Representative shall be final, subject to proceedings in accordance with 118.01 through 118.11.

107.36 Explosives and Blasting. Blasting will not be permitted and explosives may not be brought onto or kept on the site of the Project, except with prior written approval of the Authorized Representative and any other authorities having jurisdiction, including without limitation the City's Fire Department. All blasting and all purchasing, storing and handling of explosives shall be done as prescribed in any applicable federal, State or City statutes, ordinances or regulations by Persons experienced in such Work. The Contractor shall carry appropriate liability insurance and shall be responsible for any injuries to individuals or damage to property resulting from any blasting operation. The Contractor shall provide a copy of the policy of such insurance to the Engineer prior to bringing any explosives to the Project and to the Authorized Representative upon request. The Contractor shall take all necessary precautions to protect the Project, existing or adjacent property, water lines, and other underground Structures from blasting. Where there is danger to Structures or property from blasting, the charges shall be reduced and the material shall be covered with suitable timber, steel or rope mats. The Contractor shall notify all Owners of adjacent or utility property which may be affected of any intention to use explosives at least eight hours before blasting is commenced. Any inspection of use of explosives by the Engineer does not in any way reduce the responsibility of the Contractor or its Surety for damages that may be caused by such use.

107.37 Emergency. 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 any threatened damage, injury, or loss. The Contractor shall give the Engineer and the Authorized Representative prompt written notice if the Contractor believes that any significant change in the Work or variation from the Contract Documents has been caused by any emergency or action taken in response to an emergency. If the Engineer recommends that a change in the Contract Documents be made because of any emergency or action taken in response to an emergency, and the Authorized Representative approves, a Change Order will be processed, subject to final approval by the City Commission, if applicable.

107.38 Royalties and Patents. The Contractor shall pay all royalties and 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 which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents and if, to the knowledge of the Engineer, use of the specified item is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by the Engineer in the Contract Documents. 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 Authorized Representative.

ITEM 108 - SUBCONTRACTORS AND MATERIAL SUPPLIERS

108.01 Approval by City

108.02 Replacement

108.03 Contractor's Responsibility

108.04 Warranty and Guarantee

108.05 Prompt Payment

108.06 Prompt Payment Reduction and Interest

108.07 Affidavit of Claim

108.08 Claims Against Contract Bond

108.09 Assignment of Contract

108.01 Approval by City. Within ten Days of the Notice to Proceed, the Contractor shall list the Contractor's proposed Subcontractors and Material Suppliers on forms approved by the Authorized Representative and submit such forms to the Engineer for approval by the Authorized Representative. The City reserves the right to reject any Subcontractor or Material Supplier for any reason, in its sole discretion. Failure of the Engineer to notify the Contractor of rejection within ten Days of receipt of the forms shall constitute notice that the City has no objection. If the City rejects any Subcontractor or Material Supplier, the Contractor shall replace the Subcontractor or Material Supplier at no additional cost to the City.

108.02 Replacement. The Contractor shall not replace any Subcontractor or Material Supplier after execution of the Contract Form without written approval of the Authorized Representative. The Contractor shall submit to the Engineer amended approval forms and a written justification for the change of the Contractor's Subcontractors or Material Suppliers. The Contractor shall submit to the Engineer amended forms whenever any listed information changes for the Contractor's Subcontractors or Material Suppliers. The City may withhold approval of any such proposed replacement for any reason, in its sole discretion.

The City may require the Contractor to replace any Subcontractor or Material Supplier previously approved at no additional cost to the City if the Contractor is in default because of the Subcontractor's or Material Supplier's performance.

108.03 Contractor's Responsibility. The Contractor shall be fully responsible for all acts and omissions of the Contractor's Subcontractors and Material Suppliers and shall be responsible for scheduling and coordinating the Work of the Contractor's Subcontractors and Material Suppliers. Interference, disruption, hindrance, delay or impact attributable to the Contractor's Subcontractors or Material Suppliers shall be deemed to be interference, disruption, hindrance, delay or impact within the control and responsibility of the Contractor. The Contractor shall require that each of the Contractor's Subcontractors have a competent supervisor at the Project whenever Work is being performed by the Subcontractor. The Contractor agrees to bind the Contractor's Subcontractor and Material Supplier to the terms of the Contract Documents, so far as applicable to the Work of such Subcontractor or Material Supplier, and shall not agree to any provisions which seek to bind the City to terms inconsistent with or at variance from the terms of the Contract Documents. Contractor shall require the City to be named as an intended third-party beneficiary of all contracts between Contractor and Subcontractors and Material Suppliers such that the City will be entitled to enforce any rights thereunder to its benefit.

108.04 Warranty and Guarantee. The Contractor shall require each Subcontractor and Material Supplier to fully warrant and Guarantee, for the benefit of the City, the effectiveness, fitness for the purpose intended, quality and merchantability of any Work performed or item provided or installed by such Subcontractor or Material Supplier.

108.05 Prompt Payment. If a Subcontractor or Material Supplier requests payment in time to allow the Contractor to include the request in the Contractor's Contractor Payment Request, the Contractor shall pay within ten Days after receipt of payment from the City:

(a) To a Subcontractor an amount equal to percent of completion allowed by the City for the Subcontractor's Work;

(b) To a Material Supplier an amount equal to all or a portion of the Material Supplier's request for Materials furnished.

108.06 Prompt Payment Reduction and Interest. The Contractor may reduce the amount to be paid to a Subcontractor or Material Supplier pursuant to 108.05 by the amount of any retainage withheld from the Contractor and may withhold amounts necessary to resolve disputed liens or claims involving the Work of the Subcontractor or Material Supplier. If the Contractor fails to comply with the provisions of 108.05, the Contractor shall pay to the applicable Subcontractor or Material Supplier eighteen percent interest on any unpaid amount beginning on the eleventh Day after receipt of payment from the City.

108.07 Affidavit of Claim. In order to establish lien rights, Subcontractors and Material Suppliers not in privity of Contract with the Contractor must serve a notice of furnishing on the Contractor whose Contract is the Contract under which the Subcontractor or Material Supplier is performing. The notice of furnishing must be served upon the Contractor within twenty-one Days of performing the Work or furnishing the Materials. Subcontractors and Material Suppliers not in privity of Contract with the Contractor must, at the time of filing a Claim Affidavit with the Authorized Representative, provide a copy of the notice of furnishing and proof that it was received by the Contractor. In order to establish lien rights, a claimant must file a Claim Affidavit with the Authorized Representative, within one hundred twenty Days from the date of the last Work or furnishing of Materials. In order to receive priority over similar claims, the claimant must file a copy of the claim with the Montgomery County Recorder's office within thirty Days of serving the Authorized Representative. All claimants who serve the Authorized Representative, and file with the Montgomery County Recorder within thirty Days, have no priority among themselves and share in the funds prorata. Claimants, who file with the Authorized Representative, but not with the Montgomery County Recorder, are paid only if there are sufficient funds left after paying those claimants who file with the Montgomery County Recorder. The Authorized Representative shall notify the Contractor of the receipt of the claim within five Days of receiving the Claim Affidavit. A copy of the Claim Affidavit and a statement advising the Contractor of the Contractor's right to dispute the claim will accompany the notice. The Contractor shall have twenty Days to dispute the claim. If the Contractor does not notify the Authorized Representative in writing of an intention to dispute the claim within twenty Days after receipt of the Claim Affidavit, the Contractor is deemed to have assented to its correctness. The City shall detain the amount stated in the Claim Affidavit from subsequent Contractor Payment Requests and deposit said amount in an escrow

account in accordance with a general escrow agreement between the City and a bank. The escrow agent shall hold the deposit and any interest earned thereon until receipt of notice from the Authorized Representative specifying an amount to be released and the Person to whom the amount is to be released. The City reserves the right to pay a Claim Affidavit which is not timely disputed.

108.08 Claims Against Contract Bond. Laborers, Subcontractors or Material Suppliers who have furnished or delivered labor or Materials to the Project may, at any time after performing the labor or delivering the Materials, but not later than ninety Days after Final Acceptance of the Project, by the City, furnish the Surety a statement of the amount due. After furnishing the statement, laborers, Subcontractors or Material Suppliers must wait sixty Days to bring a suit for the amount due. If the Surety has not paid the claim at the expiration of sixty Days, laborers, Subcontractors or Material Suppliers may bring suit for amounts not paid, but must bring the suit within one year of Final Acceptance of the Project, by the City.

108.09 Assignment of Contract. The Contractor shall not sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or of any right, title or interest therein, without written consent of the Authorized Representative. No sale, transfer, assignment or other disposition of the Contract shall in any case release the Contractor of liability under the Contract and the Contract Bond.

ITEM 109 CONSTRUCTION PHASE SCHEDULING

- 109.01 Compliance with Schedule**
- 109.02 Responsibility of Contractor**
- 109.03 Preceding Work**
- 109.04 Coordination with City**
- 109.05 Construction Schedule**
- 109.06 Schedule Information**
- 109.07 Construction Schedule Requirements**
- 109.08 Use of Schedule and Float**
- 109.09 Approval and Acceptance Schedule**
- 109.10 Weekly Contractor Reports**
- 109.11 Monthly Progress Reports**
- 109.12 Time Recovery Plan**
- 109.13 Project Meetings**

109.01 Compliance with Schedule. The Contractor shall complete portions of the Work in such order and time as provided in the current Construction Schedule.

109.02 Responsibility of Contractor. The Contractor shall afford other Persons on the Project reasonable opportunity for the introduction and storage of Materials and Equipment and execution of Work and shall properly connect and coordinate the Contractor's Work with the Work of other Persons on the Project. The Contractor shall perform the Work so as not to interfere with, disturb, hinder, delay, or impact the Work of other Persons on the Project. If the Contractor, or any of the Contractor's Subcontractors or Material Suppliers, causes damage or injury to the property or Work of any other Person on the Project, or by failure to perform the Work with due diligence, delays, interferes with, hinders, disrupts or impacts any other Person on the Project, who suffers damage, injury or expense thereby, the Contractor shall be responsible to the other Person for such damage, injury or expense. Claims, disputes or actions between the Contractor and other Persons on the Project concerning such damages, injury or expense shall not delay completion of the Work which shall be continued by the parties to any such claim dispute or action. The Contractor shall coordinate the Work with the activities and responsibilities of other Persons on the Project, the Engineer and the City to complete the Project in accordance with the Contract Documents. In the event the Contractor fails to prosecute the Work in accordance with the Project Schedule, the Engineer may recommend that the provisions of 105.02 be invoked.

109.03 Preceding Work. If any part of the Contractor's Work is preceded by the Work of another Person, the Contractor shall inspect such preceding Work before commencing any Work, and report in writing to the Engineer any defects which render the preceding work unsuitable as related to the Contractor's work. Failure of the Contractor to make such inspection and report in writing shall constitute an acceptance of the preceding work as fit and proper for the reception of the Contractor's work, except for latent defects which such an inspection would fail to disclose.

109.04 Coordination with City. The Contractor shall supervise and coordinate the Work in conformity with any coordination from the Engineer and the Authorized Representative, as provided in the Contract Documents. The Contractor shall give reasonable notice to the Engineer

when the Engineer's presence is required for special consultations, decisions or recommendations, as required by the Contract Documents. The Contractor shall consult with the Engineer and the Authorized Representative to obtain full knowledge of all rules, regulations or requirements affecting the Project. The Contractor shall establish the regular working hours, subject to approval by the Engineer and the Authorized Representative. Night working hours and working hours on Sundays and holidays are not permitted without the prior written consent of the Engineer and the Authorized Representative. Such consent will not be provided unless the Contractor has given at least forty-eight hours' notice in writing to the Engineer. The Contractor shall cooperate with the Engineer and the Authorized Representative so as not to interfere with, disturb, hinder or delay the responsibilities of the Engineer and the City.

109.05 Construction Schedule. The Contractor shall prepare the Construction Schedule for the Project and a schedule of submittals which is coordinated with the Construction Schedule within thirty Days of the date of the Notice to Proceed or such longer period as mutually agreed between the Engineer and the Contractor in writing upon timely written request by the Contractor. The Contractor shall, within seven Days of the date of the Notice to Proceed, furnish to the Engineer a preliminary Construction Schedule for the prosecution of Work on the Project. The Engineer shall, within seven Days of receipt of the Contractor's preliminary Construction Schedule, provide comments on the preliminary Construction Schedule to the Contractor. The Contractor shall, within five Days of receipt of the comments, prepare a revised Construction Schedule to incorporate those comments and submit the revised Construction Schedule to the Engineer together with all information requested and required by the Engineer. The Engineer shall submit 4 copies of the revised Construction Schedule, together with any recommendation thereon in writing, to the Authorized Representative within three Days of receipt. The Construction Schedule shall not exceed the time limits specified in the Contract Documents and the Notice to Proceed, shall provide for reasonable, efficient and economical execution of the Work and shall be coordinated with the Work of all other Persons or the entire Project to the extent required by the Contract Documents. The Construction Schedule shall be used to plan, organize, and execute the Work, record and report actual performance and progress and show how the Contractor Plans to coordinate all Work to Contract Completion. In preparing the Construction Schedule the Contractor shall use critical path scheduling methods and shall provide without limitation, the information listed in 109.06, unless waived by the Authorized Representative in writing upon the written recommendation of the Engineer.

109.06 Schedule Information. In accordance with 109.05, the Contractor shall provide the following information:

- (a) A graphic presentation of the sequence of the Work for the Project which includes, without limitation, the Contractor's resource loading curve in the media and format required by the Engineer;
- (b) Identification of each phase of the Work and any milestone completion dates;
- (c) Identification of activities and durations for all shop drawing and other submittal review and approval, fabrication and review of mock-up Work, product review and procurement, fabrication, shop inspection and delivery including, without limitation, lead time, coordination drawing delivery, Punch List, Punch List corrections, Project close-out requirements, Contract Completion, and occupancy or utilization requirements;

- (d) Identification of disruptions and shutdowns due to other operations, facilities and functions, if any;
- (e) Identification of the critical path of the Work;
- (f) Identification of crew size and total resource hours for each activity in the Construction Schedule;
- (g) The Contractor's signature and date thereof on the Construction Schedule.

109.07 Construction Schedule Requirements. The Engineer shall provide complete Specifications for the paper and electronic formats of the Construction Schedule. The Contractor shall develop the Construction Schedule using commercially available Personal computer software acceptable to the Engineer, in graphic and tabular form. Final copies shall be provided in color and in such size as is appropriate for the level of detail and shall clearly and legibly show all relevant information. The Contractor shall provide monthly updates of the Construction Schedule and shall update the Construction Schedule if a time recovery plan is approved in accordance with 109.12, in electronic and paper formats, to the Engineer in graphic and tabular form. All base line and updated schedules shall be submitted electronically to the Engineer, in graphic and tabular form. The Contractor shall provide clear graphics, legends and other necessary data, including without limitation, milestones, constraints and items required by the Project and the Engineer. Unless waived by the Authorized Representative in writing upon written recommendation of the Engineer, each baseline and updated schedule shall show the Project name and Contract and contain lines for signatures and dates of signature for all Contractors involved in the Project. Each baseline and updated schedule shall provide activity identification and a description for each activity broken down to a maximum fifteen Day duration, responsibility of each applicable Contractor, the Contractor's resources and crew size for each activity, early start dates, early finish dates, late start dates, late finish dates, predecessor and successor activities for each activity, free float, total float and percentage completion. Each baseline and updated schedule shall identify the logic relationship between all activities and shall show all submittal dates, coordination drawing preparation, Working Drawing submittals and mark-up review and approval durations. Together with each updated schedule, the Contractor shall provide a list of all changes to the previously approved base line Construction Schedule or the previous updated Construction Schedule, including without limitation logic, float and actual start and finish dates of activities.

109.08 Use of Schedule and Float. The Construction Schedule and the Project Schedule, if applicable, shall be used as a tool for scheduling and reporting sequenced progress of the Work using early start dates and early finish dates. Free float and total float are resources of the Project and the use of float associated with an activity is not permitted without the concurrence of the Engineer, and other Contractors, if any.

109.09 Approval and Acceptance Schedule. The Contractor shall review and sign each updated Construction Schedule. The Contractor's signature or any base line or updated Construction Schedule shall serve as an affirmation of the Contractor's approval of and agreement to the Construction Schedule and a representation that the Contractor can meet the requirements of the Construction Schedule without additional compensation. Immediately after the Contractor has signed the Construction Schedule, the Engineer shall submit it and the

schedule of submittals to the Authorized Representative or return them to the Contractor with recommendations for revision. In the absence of a Construction Schedule approved by the Contractor and accepted by the Authorized Representative, the City may withhold payment from the Contractor in accordance with 114.08 and 114.09. Alternatively, the City, in its sole discretion, may backcharge the Contractor in accordance with 105.02, reassign scheduling responsibility or suspend or terminate the Contract in accordance with 119.01 through 119.04.

109.10 Weekly Contractor Reports. Unless otherwise specified by the Contract Documents, the Contractor shall, on a bi-weekly basis, prepare and submit to the Engineer a written report describing activities begun or finished during the preceding week, work in progress, expected completion of the Work, a Projection of all activities to be started or finished in the upcoming two weeks including without limitation the Contractor's workforce crew size with respect to each activity of Contractor, and total resource hours associated with such Work and any other information requested by the Engineer.

109.11 Monthly Progress Reports. Unless otherwise specified in the Contract Documents, the Engineer shall provide monthly progress reports to the Authorized Representative, which shall include recommendations for adjusting the Construction Schedule or the Project Schedule, as applicable, to meet milestone completion dates and Contract Completion dates.

109.12 Time Recovery Plan. When it is apparent to the Engineer that critical path activities, scheduled milestone completion dates, or Contract Completion dates will not be met, the Engineer shall submit to the Contractor a time recovery plan to avoid or minimize any delay. A time recovery plan may include, without limitation, increasing the Contractor's workforce in such quantities as will eliminate the backlog of Work, increasing the number of working hours per shift, shifts per workday, workdays per week, the amount of construction Equipment, or any combination thereof, rescheduling of activities to achieve maximum practical concurrency of work efforts and, if appropriate, time extensions. If the Contractor approves the time recovery plan within ten Days of receipt, a revised Construction Schedule shall be prepared by the Contractor and signed and accepted in accordance with 109.11 and, if applicable, a revised Project Schedule shall be prepared by the Engineer and approved and signed by the Contractors in accordance with 109.10. If the Contractor fails to approve a time recovery plan within ten Days of receipt, the Contractor shall immediately provide an Alternate time recovery plan to the Engineer in writing, for review and acceptance in accordance with 109.11 and, if applicable, 109.10.

109.13 Project Meetings. The Contractor and all appropriate Subcontractors shall attend Project meetings as requested by the Engineer. The purpose of the Project meetings may include, without limitation, review of progress in the Work, discussion of anticipated progress, and review of critical operations and existing and potential problems and safety matters. The Contractor shall be represented at every Project meeting by a Person authorized with signature authority to make decisions regarding possible modification of the Contract Documents. The Engineer shall notify the Contractor of the time and place of each Project meeting. The Contractor shall have any of the Contractor's Subcontractors and Material Suppliers attend a Project meeting as deemed advisable by the Contractor or as requested by the Engineer. The Engineer or the Engineer's designated representative shall prepare a written report of each Project meeting and distribute such report to the Authorized Representative and the Contractor. The Engineer or the Engineer's designated representative, as applicable, shall not delegate the duty to prepare a

written report of each Project meeting. If any Person objects to anything in a report of a Project meeting, the Person shall notify the Engineer, the Authorized Representative and any other affected Person in writing explaining the objection. The Engineer shall attach any objection made to a report of a Project meeting and any response thereto to the report.

ITEM 110 - WORKING DRAWINGS AND SAMPLES

110.01 Requirement to Provide

110.02 Samples, Tests, Cited Specifications

110.03 Source Sampling and Testing

110.04 Form of Submittals

110.05 Variation from Contract Documents

110.06 Contractor's Review

110.07 Engineer's Review

110.08 Risk of Nonpayment

110.09 Manufacturer's Statement

110.01 Requirement to Provide. Working Drawings, Samples and other submittals, including without limitation stress sheets, erection Plans, falsework Plans, cofferdam Plans, bending diagrams for reinforcing steel, formwork, Plans, and tunneling Plans, shall be provided by the Contractor for any item required by the Contract Documents but not fully described in the Drawings and Specifications, unless waived by the Engineer, and shall include, without limitation:

(a) Construction of the various parts, method of jointery, type of material, grade, quality and thickness of material, alloy of material, profiles of all sections, reinforcement, anchorage, type and grade of finish;

(b) Capacities, types of Materials and performance charts that are pertinent to the Materials and performance charts that are pertinent to the Work. Wiring diagrams, control diagrams, schematic diagrams, working and erection dimensions, arrangement and Specifications;

(c) Notwithstanding any measurements in Drawings or Specifications, where the Work involves repair, renovation, extension or alteration of, or addition to, an existing Structure, the Contractor shall make such measurements of the existing Structure as may be required to accurately attach the Work to the Structure.

110.02 Samples, Tests, Cited Specifications. Unless otherwise provided in the Contract Documents, the City shall test Samples of Materials in accordance with AASHTO, ASTM, AWWA or methods on file in the office of the Director at the expense of the City. Samples will be taken by a qualified representative of the City. References included in these Specifications to AASHTO, ASTM, AWWA, or federal Specifications shall be to the test method, sampling method or specification in effect upon the date of the notice to Bidders for the Contract. Copies of all test results will be furnished to the Contractor. The Contractor shall cooperate fully in the sampling and inspection of Materials and shall notify the Engineer immediately upon the arrival of Materials to be used in the Work. The City reserves the right to retest all Materials and Equipment that have been stored prior to incorporation of those Materials into the Project and to reject all Materials and Equipment which, when retested, do not meet the requirements of the Contract Documents. The Contractor, in all cases, shall furnish the required Samples without charge. Transports and distributors hauling bituminous material shall be equipped with an approved submerged bituminous Materials sampling device.

110.03 Source Sampling and Testing. The Engineer may undertake the sampling and testing of Materials at the source of supply. If source sampling and testing is undertaken:

- (a) The Contractor shall cooperate and assist the Engineer, including without limitation in compliance with applicable inspection, sampling and test requirements, and shall provide all necessary documentation;
- (b) The Contractor shall provide full entry at all times to the parts of the source as may concern the manufacture or production of the Materials being sampled and tested;
- (c) If required by the Engineer, the Contractor shall arrange for an approved building for the use of the inspection which building shall be located conveniently near the source and independent of any building used by the Materials producer;
- (d) The Contractor shall provide and maintain adequate safety measures at the plant at all times;
- (e) The City reserves the right to retest all Materials that were tested at the source prior to the incorporation of those Materials into the Project and to reject all Materials which, when retested, do not meet the requirements of the Contract Documents.

110.04 Form of Submittals. The Contractor shall provide a submittal letter and shall stamp and submit the working Drawings or other submittals to the Engineer in accordance with a schedule established by the Engineer and the Contractor. Unless otherwise specified in the Contract Documents, the Contractor shall submit 3 prints of all working Drawings and 4 copies of any other submittal. Only 1 print copy of all working Drawings will be returned to the Contractor by the Engineer. If the Contractor requires more than 1 copy, additional copies must be provided to the Engineer at the time of the original submission. The Engineer will not produce copies of the working Drawings. The data shown on the working Drawings shall be complete with respect to quantities, dimensions, specified performance and design criteria, Materials and similar data to show the Engineer the Materials and Equipment which the Contractor proposes to provide. Each sample shall be identified clearly as to material, supplier, and pertinent data such as catalog numbers and the use for which intended and other uses as the Engineer may require to enable the Engineer to intelligently review the submittal. All working Drawings shall indicate the applicable plan sheet and Specifications.

110.05 Variation from Contract Documents. If the working Drawings or other submittals show variations from the requirements of the Contract Documents, the Contractor shall make specific mention of such variations in the Contractor's letter of submittal to the Engineer. If the variation is acceptable to the Engineer, the Engineer shall recommend acceptance of the variation to the Authorized Representative in writing. Upon written approval of the Authorized Representative, the variation shall be incorporated into the Contract Documents. The Contractor shall not be relieved of any responsibility for deviations from the requirements of the Contract Documents by the Engineer's review of working Drawings, Samples or other submittals.

110.06 Contractor's Review. All working Drawings, Samples and other submittals shall be reviewed and stamped by the Contractor prior to submittal to the Engineer. If it is apparent to the Engineer that the Contractor has not reviewed the submittals, or has conducted an incomplete

review, the Engineer shall reject the submittals. The Contractor shall field verify conditions as necessary and make corrections of dimensions, location of various items, encroachments of Work or variations from the requirements of the Contract Documents. If required by the Contract Documents or applicable law, the Contractor shall have the working Drawings or other submittals prepared by Persons possessing expertise and experience in an appropriate trade or profession or by a licensed Engineer, landscape architect, or other design professional.

110.07 Engineer's Review. The Engineer shall review and approve or disapprove working Drawings, Samples or other submittals within fifteen Days of receipt or in accordance with the approved submittal schedule or such other period of time as is mutually agreed by the Engineer and the Contractor. The Contractor shall make any corrections required by the Engineer and shall resubmit the required number of corrected copies of working Drawings, Samples or other submittals until approved, which resubmission shall be acted upon by the Engineer with fifteen Days of receipt or such other period of time as is mutually agreed by the Engineer and the Contractor. When resubmitting submittals, the Contractor shall direct the Engineer's attention to any revisions made by noting such revisions on the resubmitted submittal. All costs incurred by the Engineer, the City or other Persons due to the failure of the initial submittal to substantially meet the requirements of the Contract Documents, or due to excessive resubmittals, for attendant delay, interference, hindrance, disruption or impact of the Project, shall be paid by the Contractor. Resubmittals in excess of two may be deemed excessive by the City. The Engineer's review and approval of working Drawings, Samples and other submittals is to determine if the items covered by such 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. The Engineer's review and approval shall not extend to means, methods, manners, techniques, sequences, procedure of construction or to safety precautions or programs incident thereto. The Engineer's review and approval of a separate item will not indicate approval of the assembly in which the item functions.

110.08 Risk of Nonpayment. No portion of the Work requiring a Working Drawing, sample or other submittal shall be commenced until the submittal, has been reviewed and approved by the Engineer. Any Work commenced by the Contractor prior to final approval of the Working Drawing, sample or other submittal by the Engineer shall be performed by the Contractor under risk that no payment will be approved or made by the City for such Work.

110.09 Manufacturer's Statement. Working Drawings on all Equipment shall include the following written statement from the manufacturer of the Equipment:

"This Equipment submitted for approval shall perform as specified when installed by the Contractor in the arrangement shown on this drawing and in the Contract Documents and in conjunction with all other accessories such as flues, breachings, 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."

ITEM 111 PREVAILING WAGE RATES

111.01 Prevailing Wages

111.02 Prevailing Wage Determination

111.03 Fines and Penalties

111.04 Wage Schedule

111.05 Payroll Reports

111.01 Prevailing Wages. The Contractor shall pay the prevailing wage rates of the Project locality, as determined by the Ohio Department of Commerce, Division of Labor and Worker Safety, Wage and Hour bureau, or the U.S. Department of Labor to laborers and mechanics performing Work on the Project, as applicable. The Contractor shall comply with the provisions, duties, obligations, and is subject to the remedies and penalties of Sections 4115.03 to 4115.22, ORC or the Davis-Bacon Act, as applicable.

111.02 Prevailing Wage Determination. The Contract Documents include pages setting forth the prevailing rates of wages as ascertained by the Ohio Department of Commerce, Division of Labor and Worker Safety, Wage and Hour Bureau, or the U.S. Department of Labor for the Project, as applicable. The City shall, within seven business Days after receipt of a notice of a change in the prevailing rates, notify the Contractor of the change. The Contractor shall make the necessary adjustment in the prevailing wage rate and shall pay any wage increase during the term of the Contract.

111.03 Fines and Penalties. Whoever violates Section 4115.08 or 4115.09, ORC, shall be fined pursuant to the applicable provisions of the Ohio Revised Code. Whoever violates division (C) of Section 4115.071, or Section 4115.10 or 4115.11, ORC is guilty of a misdemeanor of the second degree for a first offense. For each subsequent offense such Person is guilty of a misdemeanor of the first degree. Fines and penalties under the Davis-Bacon Act shall be as determined by the U.S. Department of Labor and in accordance with applicable law.

111.04 Wage Schedule. Within ten Days of the date of the Notice to Proceed, the Contractor shall provide the City's prevailing wage Coordinator a schedule of dates during the term of the Contract on which wages will be paid to employees for the Project.

111.05 Payroll Reports. The Contractor shall submit weekly payroll reports with each Contractor Payment Request, which reports shall be certified by the Contractor that the payroll is correct and complete and the wage rates shown are not less than those required by the Contract. The Contractor shall be responsible for submitting all payroll reports of the Contractor's Subcontractors. The payroll report shall indicate the week covered and shall include a list containing the name, address and social security number of each employee of the Contractor and the Contractor's Subcontractors paid for the Work. The 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, fringe benefits and all deductions from wages and net pay. The payroll report shall also list each fringe benefit and state if it is paid as cash to the employee or to a named plan. The Contractor and the Contractor's

Subcontractors shall also submit apprenticeship agreements for all apprentices utilized on the Project.

ITEM 112 INSURANCE

112.01 Contractor's Liability Insurance

112.02 Policy Limits

112.03 Explosion, Collapsed and Underground Insurance

112.04 Builder's Risk Insurance

112.05 Coverage Amount

112.06 Railroad Protective Insurance

112.07 Insurance Policy Requirements

112.08 Renewal Certificates

112.09 Waivers of Subrogation

112.01 Contractor's Liability Insurance. The Contractor shall purchase and maintain such liability and other insurance as will protect the Contractor from claims described below which may arise out of or result from the Contractor's performance or obligations under the Contract Documents, whether due to action or inaction by the Contractor, a Subcontractor, any Person directly or indirectly employed by the Contractor or a Subcontractor or any Person for whom the Contractor or a Subcontractor is responsible, or by any Person for whose acts the Contractor or a Subcontractor may be liable:

- (a) Claims under workers' compensation, occupational sickness or disease, disability benefit and other similar employee benefit acts;
- (b) Claims for damages because of bodily injury, disease, illness, death or Personal injury, and other claims usually covered by bodily injury liability insurance;
- (c) Claims for damages because of injury to or destruction of property and other claims usually covered by property damage liability insurance.

The Contractor shall comply with all provisions of the Ohio Workers Compensation Act and all rules of the Ohio Bureau of Workers' Compensation. In addition, if a portion of the Work is performed from a barge or a ship or requires unloading Materials from a barge or a ship on a navigable waterway of the United States, the Contractor shall arrange coverage for that portion of the Work under the Longshore and Harborworkers' Compensation Act, 33 U.S.C. Section 901, et seq., and the Jones Act, 5 U.S.C. Section 751, et seq. and shall provide proof of such coverage to the City. Comprehensive Automobile Liability Insurance shall cover owned, non-owned and hired vehicles.

112.02 Policy Limits. A Commercial General Liability policy and Business Automobile Liability policy shall be maintained to provide insurance as described below. An Umbrella or Excess Liability policy may be used in combination with the Commercial General Liability and business Automobile insurance to meet such limits:

- (a) Policy Limits Commercial General Liability**
 - \$2,000,000 General Aggregate
 - \$2,000,000 Products/Completed Operations Aggregate
 - \$1,000,000 Occurrence Limit
 - \$1,000,000 Personal and Advertising Injury Limit
 - \$100,000 Fire Legal Liability Limit
 - \$10,000 Medical Payments
- (b) Policy Limits Comprehensive Automobile Liability**
 - \$1,000,000 Bodily Injury & Property Damage Occurrence Limit

Contracts in the amount of one hundred thousand dollars or less shall require coverage in the amount of not less than two million dollars general aggregate and one million dollars per occurrence. Contracts in excess of one hundred thousand dollars, but not more than five million dollars shall require coverage in the amount of not less than three million dollars general aggregate and per occurrence. Contracts exceeding the amount of five million dollars shall require coverage in an amount to be determined by the Authorized Representative but in no case less than five million dollars general aggregate and per occurrence. Such policies shall be endorsed to provide that the General Aggregate Limit applies separately to each of the insured Contractor's Projects. By requiring such insurance and insurance limits herein, the City does not represent that coverage and limits will necessarily be adequate to protect the Contractor, and such coverage and limits shall not be deemed as a limitation on the Contractor's liability under the indemnities granted to the City.

112.03 Explosion, Collapsed and Underground Insurance. For any demolition, excavating, tunneling, shoring or similar operations, the Contractor shall purchase and maintain Explosion, Collapse and Underground (XCU) coverage with a limit of liability equal to such limit as specified in 112.02. In addition, if blasting is to be performed, the Contractor shall purchase and maintain XCU coverage providing a minimum Aggregate Limit of 5,000,000 dollars and Each Occurrence Limit of 1,000,000 dollars.

112.031 Pollution Liability Insurance. If required by the Contract Documents, Contractor shall purchase and maintain pollution liability insurance with a limit for any one incident of not less than \$1,000,000 and an aggregate limit of not less than \$2,000,000.

112.032 Completed Operations Insurance. Contractor shall purchase and maintain completed operations coverage to cover such claims for bodily injury or property damage arising out of the Contractor's completed operations, which coverage shall be maintained for no less than five (5) years following final payment.

112.04 Builder's Risk Insurance. Unless otherwise specified in the Contract Documents, the Contractor shall provide and maintain, during the progress of the Work and until the execution of the Certificate of Contract Completion by the Authorized Representative, a builder's risk insurance policy to cover all Work in the course of construction including falsework, temporary buildings and Structures and Materials used in the construction process, stored on or off site, or while in transit. The amount of coverage shall equal the total completed value of the Project (including the value of permanent fixtures and decorations). Such insurance shall be on a special cause of loss form, which provides coverage on an open perils basis insuring against the direct physical loss of or damage to covered property including flood and earthquake. It shall also include debris removal and demolition occasioned by enforcement of any applicable legal requirement, and shall cover reasonable compensation for the City's services and expenses required to limit further loss. Coverage must include provision to pay the reasonable extra costs of 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, Equipment and supplies necessary to such repair or replacement. The builder's risk policy shall protect both the Contractor and the City from loss and provide coverage for Materials in transit or stored off site and identified for the Project. Coverage for other perils may be required if specified in the Special Provisions.

112.05 Coverage Amount. Unless otherwise specified in the Contract Documents, the builder's risk policy shall be written in the amount equal to one hundred percent of the Contract price, including landscaping, paving and other sitework. The builder's risk policy shall specifically permit and allow for partial occupancy by the City prior to Final Acceptance of the Project by the City.

112.06 Railroad Protective Insurance. Where the Contract requires railroad Protective Insurance and no specific Bid item is provided in the Proposal for the payment of the premium therefore, the cost of such insurance shall be included in the various other Bid items in the Contract.

112.07 Insurance Policy Requirements. Each policy of insurance required to be purchased and maintained by the Contractor shall be obtained from an insurance company authorized by the Ohio Department of Insurance to do business in the State and shall name the City as an additional insured or loss payee, as applicable; provided, however, that such designation shall not cause any claim between the Contractor and the City to be waived except as set forth in 112.09. Each policy and the respective certificate of insurance shall expressly provide that no less than thirty Days prior written notice shall be given to the City in the event of cancellation, non-renewal, expiration or material alteration of the coverage contained in such policy or evidenced by such certificate of insurance. Each policy shall provide that the City shall be covered notwithstanding any action, omission or negligence of the Contractor. Each policy shall be primary and non-contributory. Each policy must include contractual liability insurance covering the Contractor's indemnity obligations. The Contractor shall furnish the City, when requested, a certified copy of any insurance or additional insured or loss payee endorsement required to be purchased or maintained by the Contract Documents. In no event shall any failure of the City to demand a certified copy of any required insurance or endorsement be construed as a waiver of the obligation of the Contractor to obtain insurance required to be purchased or maintained by the Contract Documents. Except for its completed operations insurance, the Contractor shall maintain all insurance in the required amounts, without interruption, from the date

of the execution of the Contract Form until the date of approval of the Certificate of Contract Completion by the Authorized Representative. The Contractor shall require all Subcontractors to provide Workers' Compensation, CGL, and Automobile Liability insurance with the same minimum limits specified herein, unless the Owner agrees to a lesser amount and require the City be named as an additional insured and/or loss payee under such policies. Failure to maintain the required insurance during the time specified shall be cause for termination of the Contract. If the Contractor fails to purchase and maintain, or require to be purchased and maintained, any insurance required under these Specifications, the Owner may, but shall not be obligated to, upon three (3) days written notice to the Contractor, purchase such insurance on behalf of the Contractor and shall be entitled to be reimbursed by the Contractor upon demand. Insurance policies required to be purchased and maintained by the Contractor may include a reasonable loss deductible and exclusions, which shall be the responsibility of the Contractor to pay in the event of loss. The prompt repair or reconstruction of the Work as a result of an insured loss or damage shall be the Contractor's responsibility and shall be accomplished at no additional cost to the City.

112.08 Renewal Certificates. If the Contractor provides certificates of insurance showing expiration prior to the date of final completion, the Contractor shall provide new certificates to the City showing continuing coverage prior to expiration.

112.09 Waivers of Subrogation. The City and the 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 obtained pursuant to Item 112 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the City as fiduciary.

ITEM 113 INDEMNIFICATION

113.01 Indemnification for Injury or Damage

113.02 Indemnification for Patent or Copyright Use

113.01 Indemnification for Injury, Damage or Breach of Contract. To the fullest extent permitted by law, the Contractor shall defend, indemnify and hold harmless the City, the Engineer, any participating railroad or railway company, any property Owner or lessee of adjacent property, or utilities and any private Person providing financing for the Project, their respective members, officials, officers, consultants, agents, representatives and employees, in both individual and official capacities, from and against all claims, damages, losses, and expenses, direct, indirect or consequential, including but not limited to all fees and charges of design professionals, attorneys, and other professionals and all court, arbitration, or other dispute resolution costs, arising out of or resulting from any claim or action, legal or equitable, caused or alleged to have been caused by the Contractor's performance of the Work or any breach of the Contractor's obligations under the Contract Documents, including but not limited to the breach of any warranty provided in the Contract Documents.

In the event of any such injury, including death, or loss or damage, or claims therefore, the Contractor shall give prompt notice thereof to the Engineer and the Authorized Representative. This provision is intended to be, and shall be construed, as consistent with, and not in conflict with, Section 2305.31 ORC, to the fullest extent permitted. The indemnification obligations of the Contractor under this 113.01 shall not extend to the liability of the Engineer, the Engineer's officials, consultants, agents, representatives or employees for negligent preparation or approval of Drawings, specification, Change Orders, opinions, and any other responsibility of the Engineer, except to the extent covered by the Contractor's insurance.

113.02 Indemnification for Patent or Copyright Use. To the fullest extent permitted by law, the Contractor shall indemnify, hold harmless and defend the City and the Engineer, their respective members, officials, officers, consultants, agents, representatives and employees, in both individual and official capacities from and against all claims, damages, losses and expenses arising out of the Contractor's infringement of patent rights or copyrights.

ITEM 114 CONTRACTOR PAYMENT

- 114.01 Contract Cost Breakdown**
- 114.02 Contractor Payment Request**
- 114.03 Payment Date**
- 114.04 Labor Payments**
- 114.05 Material Payments**
- 114.06 Retainage**
- 114.07 Retainage Reduction with Consent of Surety**
- 114.08 Payments Withheld**
- 114.09 Payments Detained**
- 114.10 Measurement of Quantities**
- 114.11 Final Payment Request**
- 114.12 Final Payment Date**
- 114.13 Waiver of City's Claims**
- 114.14 Waiver of Contractor's Claims**

114.01 Contract Cost Breakdown. The Contractor shall submit to the Engineer a full, accurate and detailed estimate (the Contract Cost Breakdown) of the various kinds of labor to be performed and material to be furnished, with separate amounts shown for labor and Materials for each branch of Work, following the preferred titles and sequences of sections in the format used by the Engineer in developing the Specifications. The grand total shown on the Contract Cost Breakdown must equal the total Contract price. The City reserves the right to use the approved Contract Cost Breakdown to determine the cost or credit resulting from any change in the Work. The first item should be actual aggregate cost of Contract Bond, insurance, permits and tests required for the Work. The amounts for labor and material shall accurately reflect the cost for each item. Separate items shall not be shown for overhead or profit, but shall be included in the totals for labor and Materials. Whenever the material allocation exceeds fifty-five percent of the Contract price, the Contractor shall provide, upon request, sufficient information to support such higher percentage. Subcontract Work shall show amounts for labor and Materials. Fringe benefits shall be shown as a part of labor costs. When more than one major Structure is included in the Contract, the Contract Cost Breakdown shall be subdivided accordingly if requested by the Engineer, with cost details for each Structure shown separately. A line item shall be included for commissioning, Punch List Work, Project record document submittals, delivery of inventory and specified training. The Contract Cost Breakdown will be returned to the Contractor for resubmittal if it does not meet the requirements set forth above or contains insufficient items or details of the Work. No payment will be made without an approved Contract Cost Breakdown.

114.02 Contractor Payment Request. The Contractor shall submit monthly to the Engineer an itemized Payment Request for Work performed based upon the Contract Cost Breakdown on a form satisfactory to the Authorized Representative. The Contractor Payment Request shall be supported by documentation substantiating the Contractor's right to payment. The Contractor shall supply any additional documentation the Engineer may request in connection with each payment to the Contractor. Certified payroll reports for the period of time indicated shall be attached to one copy of every Payment Request. The Contractor shall list on the Contractor Payment Request any approved Change Orders processed and performed during the time covered by the Payment Request.

114.03 Payment Date. Payment of an approved Payment Request shall be made within thirty Days from the date of approval by the Engineer. The City reserves the right to require proof of the renewal of required insurance as a condition precedent to payment. Payments due and not paid to the Contractor within such thirty Day period shall bear interest from the date payment is due under the Contract Documents at the rate paid by the STAR Account in accordance with 120.04. The amount of Liquidated Damages to which the City is apparently entitled under the Contract Documents may be deducted from any Payment Request by the Engineer and the Authorized Representative.

114.04 Labor Payments. Partial payments to the Contractor for labor performed under either a Unit Price or lump sum Contract shall be made at the rate of ninety percent of the amount invoiced through the Payment Request which shows the total Contract Completion at fifty percent or greater. After the Contract is fifty percent complete, as evidenced by payments in the amount of at least fifty percent of the Contract price to the Contractor, partial payments for labor performed under either a Unit Price or lump sum Contract shall be made at the rate of ninety-five percent of the amount involved.

114.05 Material Payments. Through the Payment Request which shows total Contract Completion at fifty percent or greater, the City shall pay to the Contractor a sum at the rate of ninety percent of the invoice cost, not to exceed the applicable Bid amount in a Unit Price or lump sum Contract, for material delivered on the site of the Project, or other point in the vicinity of the Project, or other storage site approved by the Engineer, provided the Contractor provides the following information with the Payment Request:

- (a) 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;
- (b) A certification of Materials stored off site, prepared by the Contractor and signed by the Engineer 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. All costs incurred by the Engineer to visit a storage site, other than the areas adjacent to the Project, shall be paid by the Contractor.

After the Contract is fifty percent complete, as evidenced by payments in the amount of at least fifty percent of the Contract price to the Contractor, partial payments for Materials furnished under either a Unit Price or lump sum Contract shall be made at the rate of ninety-five percent of the amount involved. When payment is allowed on account of material delivered on the site of the Project or in the vicinity thereof or under the possession and control of the Contractor but not yet incorporated therein, such material shall become the property of the City, but if such material is stolen, destroyed, or damaged by casualty before being used, the Contractor will be required to replace it at the Contractor's expense. Any such material not ultimately incorporated into the Project may, at the option of the City, be retained by the City or returned to the Contractor for credit to the City of a proportionate amount. Completed line items concealed, underground and buried and not subject to final Punch List may be paid for at the rate of one hundred percent. Such completed line items subject to a final Punch List requiring testing or start-up shall be paid at the rate of ninety-eight percent.

114.06 Retainage. The City will not deposit retainage in any escrow account and will not pay interest on retainage. Any contrary provisions of 153.12, 153.13, 153.14 and 153.63, ORC, do not apply to this Contract. Payment of retainage to the Contractor shall not be due until thirty Days after approval of a final Contractor Payment Request by the City and execution of the Certificate of Contract Completion by the City. Any reduction or release of retainage, or portion thereof, shall not be a waiver of the City's right to retainage in connection with other payments to the Contractor, or any other right or remedy the City has under the Contract Documents, at law or in equity.

114.07 Retainage Reduction with Consent of Surety. Upon consent by the Contractor's Surety, the City may reduce the amount of funds retained for the faithful performance of Work by fifty 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 without limitation, the following:

- (a) Completion of the Work;
- (b) All interference, disruption, hindrance, delay and impact claims;
- (c) All Liquidated Damages; and
- (d) All additional expenses incurred by the City.

114.08 Payments Withheld. The Engineer shall have the authority to recommend to the City that payments be withheld from, or Liquidated Damages be assessed against and withheld from, a Payment Request, stating the reasons for such recommendation. The City reserves the right to decline to approve any Contractor Payment Request or part thereof, or because of subsequent evidence or inspection, may nullify any previous Payment Request, in whole or in part, to such extent as may be necessary in the Authorized Representative's opinion to protect the City from loss because of:

- (a) Defective Work not remedied;
- (b) Damage caused by the Contractor;
- (c) Failure to comply with the requirements of Sections 4115.03 to 4115.22, ORC or the Davis-Bacon Act as applicable; and/or
- (d) Liquidated Damages.
- (e) Other damages the City has incurred or is expected to incur due to Contractor's fault.

If a basis for withholding payment is removed, payment shall be made for the amount withheld because of the basis.

114.09 Payments Detained. Whenever the City receives a Claim Affidavit, the Authorized Representative shall detain the stated amount from the Contractor's subsequent Payment Requests unless the Contractor provides a release and waiver of lien with a Payment

Request. The release and waiver of lien shall be executed by the Person supplying labor, Materials or services on a Project, which has or may have a right of claim against the Contractor's proceeds. If the City detains an amount as set forth above, such action shall not be construed as conferring any right on such Subcontractor or Material Supplier, nor as enlarging or altering the application or effect of the existing lien law.

114.10 Measurement of Quantities. For all Contracts, except lump sum Contracts, after an item of the Work is completed and before final payment is made by the City, the Engineer will determine the quantities of various items of Work performed as the basis for final payment. The Contractor, in case of Unit Price items, will be paid as provided in 103.19. After issuance of a Certificate of Contract Completion in accordance with 115.05, the Engineer shall prepare a final estimate for payment based on the actual quantities of completed Work and deducting there from all previous payments made to the Contractor. Any prior estimate is subject to correction in the final estimate.

114.11 Final Payment Request. The Contractor, as a condition precedent to execution of the Certificate of Contract Completion and to final payment, shall provide all documents required pursuant to 115.06 for approval by the Engineer with the Contractor's final Payment Request.

114.12 Final Payment Date. Payment of the final Payment Request shall be made within thirty Days from the date of approval by the Engineer unless the City has reason to withhold amounts pursuant to the terms of this Agreement. Payments due and not paid to the Contractor within such thirty Day period shall bear interest from the date payment is due under the Contract Documents at the rate paid by the STAR Account in accordance with 120.04.

114.13 Waiver of City's Claims. The making of final payment by the City shall constitute a waiver of claims by the City except those relating to unresolved claims of the Contractor or the City and those arising after Contract Completion including, without limitation, the following:

- (a) Defective or nonconforming Work;
- (b) Error by Contractor;
- (c) Outstanding liens, claims, security interests, or other encumbrances arising out of the Contract Documents and unsettled;
- (d) Failure of the Contractor to comply with any warranties or Guarantees required by the Contract Documents;
- (e) audits performed by the City after final payment;
- (f) any claims, damages, losses, or expenses for indemnification under Item 113;
- (g) Inadvertent overpayment by the City.

114.14 Waiver of Contractor's Claims. The acceptance of final payment by the Contractor shall constitute a waiver of all claims against the City except those that the Contractor has previously made in writing in accordance with 118.01 through 118.11 and which remain unresolved at the time of final payment. This provision is intended to be, and shall be construed as, consistent with, and not in conflict with, Section 4113.62 ORC, to the fullest extent permitted.

ITEM 115 FINAL INSPECTION AND ACCEPTANCE

- 115.01 Contractor's Request**
- 115.02 Engineer's Punch List**
- 115.03 Completion and Correction of Punch List Items.**
- 115.04 Deferred Items**
- 115.05 Certificate of Contract Completion**
- 115.06 Project Record Document Submittals**
- 115.07 Record Drawings**
- 115.08 Guarantee**
- 115.09 Warranty**
- 115.10 Exercise of Guarantee or Warranty**
- 115.11 Final Cleaning**
- 115.12 Final Cleaning Remedies**
- 115.13 Work After Final Cleaning**

115.01 Contractor's Request. When the Work or a designated portion thereof, is nearly complete, the Contractor shall submit a request for a Final Inspection of the Work ("the "Final Inspection") to the Engineer in writing.

115.02 Engineer's Punch List. The Engineer shall, within seven Days of receipt of the request for Final Inspection, notify the Contractor of acceptance or rejection of the request for Final Inspection, stating reasons for any rejection. Upon acceptance of the Contractor's request, the Engineer shall conduct the Final Inspection to determine whether the Work or the designated portion thereof, is in conformity with the Contract Documents. The Engineer shall notify the Contractor and the Authorized Representative of the scheduled time of the Final Inspection. Within three Days of the Final Inspection, the Engineer shall notify the Contractor of any items of Work remaining in a Defective, incomplete or unacceptable condition. The list of such items shall be known as the Engineer's Punch List.

115.03 Completion and Correction of Punch List Items. Within fourteen Days of receipt of the notice required by 115.02, the Contractor shall complete and correct all items on the Engineer's Punch List. If the Contractor does not complete the items on the Engineer's Punch List within fourteen Days of receipt of the notice, the provisions of 105.02 may be invoked. If the Work on the Engineer's Punch List cannot be completed within fourteen Days of receipt of the notice, the Contractor shall justify to the reasonable satisfaction of the Engineer the reasons the items cannot be so completed, and the Contractor shall propose, for approval of the Engineer, a time when such items will be completed. If the Contractor fails to timely correct the items on the Punch List, the City, in its discretion, may perform the Work by itself or others and the cost thereof shall be charged against the Contractor. If the balance of the Contract price is insufficient, the Contractor and/or its surety will pay the Owner the balance on demand. The Contractor's warranties and obligations under the Contract Documents shall remain in full force and effect and cover any remedial work even if performed by others. Failure of the Engineer to include any items on the Engineer's Punch List shall not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents. If multiple inspections of items on the Engineer's Punch List are required due to the Contractor's failure to properly and timely complete

them, the Contractor shall be responsible for any additional costs incurred by the Contractor, other Persons, the Engineer and the City resulting from any attendant delay.

115.04 Deferred Items. With the approval of the Engineer, when upon Final Inspection, items of Work cannot be completed because of seasonal conditions, such as bituminous paving or landscaping, or if the Authorized Representative agrees that a particular item need not be completed until a subsequent date, the Authorized Representative may release payment to the Contractor less twice the cost of completing the remaining Work as determined in the sole discretion of the Authorized Representative.

115.05 Certificate of Contract Completion. When all items on the Engineer's Punch List have been corrected to the satisfaction of the Engineer and the provisions of 115.06 through 115.14 have been fulfilled, the Engineer shall process a Certificate of Contract Completion for execution by the Authorized Representative. The City reserves the right of Final Acceptance of the Project.

115.06 Project Record Document Submittals. The Contractor, as a condition precedent to execution of the Certificate of Contract Completion, release of retainage and final payment, shall provide all Project record documents to the Engineer for approval, which may include, without limitation:

- (a) Certificate of occupancy, if required;
- (b) Any inspection certificates required such as pressure piping, elevator, boiler, electrical, plumbing or piping purification;
- (c) Letter of Approval for fire suppression system, if required;
- (d) Any operating and maintenance manuals, which shall be organized into suitable sets of manageable size. Indexed data shall be bound in individual binders, with pocket folders for folded sheet information and appropriate identification shall be marked on the front and the spine of each binder;
- (e) Neatly and accurately marked sets of As-built Drawings and other Contract Documents reflecting the actual construction of the Project;
- (f) Reproducible detailed Drawings reflecting the exact location of any concealed utilities, mechanical or electrical systems and components;
- (g) Assignment to the City of all warranties and guaranties, including the most recent address and telephone number of any Subcontractors, Material Suppliers, or manufacturers;
- (h) An affidavit from the Contractor to certify that all Subcontractors and Material Suppliers have been paid in full for all Work performed or Materials furnished for the Project and an affidavit from each Subcontractor and Material Supplier that the Subcontractor or Material Supplier has been paid in full for all Work performed or Materials furnished for the Project;
- (i) Final certified payroll reports;

(j) Affidavit to certify that the Contractor and an affidavit from each Subcontractor to certify that the Subcontractor has complied with all requirements of Sections 4115.03 to 4115.22, ORC, or the Davis-Bacon Act, as applicable.

115.07 Record Drawings. Unless otherwise provided in the supplemental Specifications or Special Provisions, upon completion of the Work on Projects administered by the Water Engineering Manager of the City's Department of Water or administered by the Chief Engineer of the Department of Aviation, the Contractor shall organize the As-built Drawings into manageable sets, bind the sets with durable paper cover sheets, certify to the accuracy of the As-built Drawings by signature thereon, and deliver the As-built Drawings to the Engineer. The Engineer shall revise the original Contract drawing tracings or computer files with the information contained on the As-built Drawings provided by the Contractor and create the Record Drawings. The City may thereafter use the As-built Drawings for any purpose relating to the Project including, without limitation, additions to or completion of the Project.

115.08 Guarantee. The Contractor shall provide a Guarantee to the City that all Work is in conformity with the Contract Documents and free from defects in workmanship, Materials and Equipment for full period permitted under Ohio law. The Contract Bond shall remain in effect for the full Guaranty period, unless the Contractor shall provide a Maintenance Bond in form and substance and from a Surety satisfactory to the City. The Guarantee time period shall commence on the date of approval of the Certificate of Contract Completion by the Authorized Representative, unless otherwise provided in writing. The Guarantee time period for any incomplete or uncorrected Work at the time of Partial Occupancy or Use, if any, shall commence with the date of approval of the Certificate of Contract Completion by the Authorized Representative, unless otherwise provided in writing. The Guarantee provided in this 115.08 shall be in addition to, and not in limitation of, any other Guarantee, Warranty or remedy provided by law or by the Contract Documents.

115.09 Warranty. The Contractor shall, prior to installing material or Equipment which is subject to a Warranty, provide a copy of the Warranty to the Engineer for review and approval.

115.10 Exercise of Guarantee or Warranty. If defects in workmanship, material or Equipment become apparent within the applicable Guarantee or Warranty period, the Authorized Representative shall notify the Contractor in writing and provide a copy of the notice to the Engineer. Within ten Days of receipt of the notice, the Contractor shall visit the Project in the company of a representative of the City to determine the extent of all defects and shall promptly repair or replace the defects, including all adjacent property damaged as a result of such defects or as a result of remedying the defects. If the repair or replacement is considered by the Authorized Representative to be an emergency, the Authorized Representative may require the Contractor to visit the Project within one Day of receipt of the notice. The Contractor shall be fully responsible for the cost of and all expenses associated with temporary Materials or Equipment required during the repair or replacement of the defects, including without limitation labor, permits and other incidentals. If the Contractor does not promptly repair or replace the defects, the City may repair or replace the defects and charge the cost thereof plus any Consultant and attorney fees incurred by the City in enforcing its Guaranty or warranty rights to the Contractor or the Contractor's Surety. Work which is repaired or replaced by the Contractor shall be inspected and

accepted by a representative of the City and shall be Guaranteed by the Contractor for the remainder of the original Guarantee time period.

115.11 Final Cleaning. At the completion of the Work, the Contractor shall restore all property not designated for alteration by the Contract Documents to as near its original condition as practicable and clean the site of the Project and adjacent property of all dust, mud, waste Materials, and rubbish attributable to the Work and shall remove any temporary controls required pursuant to the storm water pollution prevention plan and permit.

115.12 Final Cleaning Remedies. Final cleaning shall be done to the satisfaction of the Engineer and the Authorized Representative. If the Contractor fails to clean up at completion of the Work, the provision of 105.02 may be invoked. If a dispute arises as to responsibility for final cleaning, the Engineer may employ City employees or engage a qualified cleaning company, to perform the clean up and deduct the cost from amounts due to the Contractor as the Engineer recommends and the Authorized Representative determines to be appropriate. The decision of the Authorized Representative on the responsibility for such cost shall be final, subject to 118.01 through 118.11.

115.13 Work After Final Cleaning. If any Work is performed after a final cleaning by the Contractor, the Contractor shall clean any affected area again as provided in 115.11 and 115.12 so that upon Contract Completion, the Project shall be left ready for occupancy or utilization by the City.

ITEM 116 TIME

116.01 Time of Essence

116.02 Time Extensions

116.03 Critical Path

116.04 Extension Sole Remedy

116.05 Time for Contract Completion

116.06 Liquidated Damages

116.01 Time of Essence. Time is of the essence to the Contract Documents and all obligations thereunder. By executing the Contract Form, the Contractor acknowledges that the time for Contract Completion is, and by signing the Construction Schedule and Project Schedule, if applicable, that any specified milestone completion dates are, reasonable taking into consideration the usual weather and other conditions prevailing in the locality of the Project. The Contractor agrees that the Notice to Proceed shall establish the date for commencement of the Work. The Contractor agrees that the City has entered into, or may enter into, agreements or representations for use of all or part of the Project based upon the Contractor achieving Final Acceptance within the time for Contract Completion. The Contractor agrees that the Work will be prosecuted in a reasonable, efficient and economical sequence, in cooperation with the Engineer and in the order and time as provided in the current Construction Schedule and Project Schedule, if applicable. The Contractor shall perform the Work so as not to interfere with, disrupt, hinder, delay or impact the Work of other Persons on the Project and of such other Persons' Subcontractors and Material Suppliers. The Contractor agrees that the possibility that the Contractor may be subject to interference, disruption, hindrance, delay or impact in the progress of the Work from any and all causes is within the contemplation of the Contractor and the City and that the sole remedy for such interference, disruption, hindrance, delay or impact shall be an extension of time granted pursuant to 116.02, except where the Contractor establishes such interference, disruption, hindrance, delay, or impact was proximately caused by an improper action or failure to act by the Owner, in which case the Contractor may be entitled to additional compensation.

116.02 Time Extensions. If the Contractor is interfered with, disrupted, hindered, delayed or impacted at any time in the progress of the Work by any of the following causes, the time for Contract Completion shall be extended for such reasonable time which the Authorized Representative determines, in consultation with the Engineer, has been caused by the interference, disruption, hindrance, delay, or impact in the Work:

- (a) Due to suspension of the Work for which the Contractor is not responsible; unusually severe weather conditions not normally prevailing in the particular season; labor dispute, excluding informational pickets; fire; or flood; or
- (b) Due to any unforeseeable cause beyond the control and without fault or negligence of the Contractor;
- (c) The Contractor shall request any extension of time pursuant to 117.01 through 117.11.

116.03 Critical Path. Notwithstanding any other provision of the Contract Documents, time extensions will depend upon the extent to which the Work on the critical path of the Construction Schedule is affected, or if the Project involves multiple Contractors the extent to which Work on the critical path of the Project Schedule is affected. A Change Order granting a time extension may provide that the time for Contract Completion will be extended for only those specific elements so interfered with, disrupted, hindered or delayed and that remaining milestone completion dates will not be altered and may further provide for adjustment of Liquidated Damages.

116.04 Extension Sole Remedy. Any extension of time granted pursuant to 116.02 shall be the sole remedy which may be provided by the City, unless Contractor has established that a delay was proximately caused by an improper action or failure to act by the Owner, in which case Contractor may be entitled to additional compensation. . It is within the contemplation of the Contractor and the City that the Contractor may accelerate its performance to meet the Construction Schedule and that such acceleration is solely within the discretion of the Contractor.

116.05 Time for Contract Completion. The Contractor shall diligently prosecute the Work and shall complete all Work so that Final Acceptance occurs on or before the number of consecutive Days set forth in the Contract Documents following the date set forth in the Notice to Proceed, unless the Contractor timely requests and the City grants an extension of time in accordance with the Contract Documents. The period of time established by the preceding sentence is referred to herein as the time for Contract Completion. Each applicable portion of the Work shall be completed upon the respective milestone completion date unless the Contractor timely requests and the City grants an extension of time in accordance with the Contract Documents.

116.06 Liquidated Damages. Upon failure to complete all Work within the time for Contract Completion, the City shall be entitled to retain or recover from the Contractor, as Liquidated Damages, and not as a penalty, the applicable amount set forth in the following table for each and every Day thereafter until Contract Completion, unless the Contractor timely requests and the City grants an extension of time in accordance with the Contract Documents.

LIQUIDATED DAMAGES	Contract
Contract Amount	Completion
\$0 to \$50,000	\$150
more than \$50,000 to \$150,000	\$250
more than \$150,000 to \$500,000	\$500
more than \$500,000 to \$2,000,000	\$1,000
more than \$2,000,000 to \$5,000,000	\$2,000
more than \$5,000,000 to \$10,000,000	\$2,500
more than \$10,000,000	\$3,000

The amount of Liquidated Damages is agreed upon by and between the Contractor and the City because of the impracticability and extreme difficulty of ascertaining the actual amount of damage the City, its taxpayers and the public would sustain. Liquidated Damages only replace the City's actual damages for delays, are not the City's exclusive remedy for breach by the Contractor and are not to be construed in any way as a limitation of any other rights or remedies available to the City under the Contract Documents or otherwise. If a delay of the critical path in

completion of the Project occurs which is caused by the City and the Contractor concurrently, the applicable Liquidated Damages shall be apportioned, and the specific number of Days for which the City is solely responsible for shall be deducted from the total number of Days of the concurrent delay used in calculating the Liquidated Damages and the Contractor shall pay Liquidated Damages for the remaining number of Days of delay. In addition to the amounts specified above, the City may charge the Contractor for all inspection regardless of any time extension.

ITEM 117 - CHANGES IN THE WORK

- 117.01 Change Order**
- 117.02 Payment of Change Order**
- 117.03 Requirement to Perform Changed Work**
- 117.04 Change Order Price Determination**
- 117.05 Change Order Procedures**
- 117.06 Change Order Process**
- 117.07 Paperwork Consolidation**
- 117.08 Change Order Numbering System**
- 117.09 Project Contingency Funds**
- 117.10 Change Order Pricing Guidelines**
- 117.11 Differing Site Conditions**
- 117.12 Time Extension**

117.01 Change Order. The City Commission or the Authorized Representative, without invalidating the Contract, may order changes in the Work consisting of additions, deletions or other revisions, including without limitation revisions resulting from an extension granted in accordance with 116.04. To the extent the time for Contract Completion or the Contract price is affected, the Contract may be adjusted by Change Order in accordance with 117.01 through 117.12. The Contractor shall proportionately increase the amount of the Contract Bond whenever the Contract price is increased. If notice of any change affecting the Contract is required by the provision of any Contract Bond, the giving of any such notice shall be the Contractor's responsibility, and the amount of each applicable Contract Bond shall be adjusted accordingly.

117.02 Payment of Change Order. The Contractor shall not proceed with any change in the Work without the required written Change Order. If the Contractor believes that any item is not Work required by the Contract Documents or reasonably inferred therefrom to produce the intended results, the Contractor shall obtain a Change Order before proceeding with such item. Except as provided in 118.01 through 118.11, failure to obtain such a Change Order shall constitute a waiver by the Contractor of any claim for additional compensation for such item. The Contractor understands and agrees that agreement to a Change Order is final and without reservation of any rights.

117.03 Requirement to Perform Changed Work. If the Contractor does not agree to, or fails or refuses to sign, a Change Order, the Contractor shall perform any Work related to the Change Order as required by the Authorized Representative in accordance with 117.04; provided, however, the Contractor may seek compensation and time extension in accordance with 117.04 and 117.10 through 117.12, as applicable, and 118.01 through 118.11 for any such Work performed. The City reserves the right to cancel or modify any Change Order authorization.

117.04 Change Order Price Determination. The maximum cost or credit resulting from a change in the Work shall be determined as provided in 117.04 through 117.10. Proposals which do not set forth all information required by 117.05 and 117.10 will not be considered or accepted under any circumstances. A Unit Price Proposal shall only be valid when incorporated into the Contract by Change Order; provided, however, that Unit Price Work set forth on the Bid, included

in the Contract price and which does not exceed the scheduled quantities on the Bid may be performed and paid for without a Change Order. The amounts allowed for overhead and profit are all-inclusive, include all Contractor Project costs relating to field and home office operations, and no additional or other amounts for overhead or profit shall be allowed. The maximum cost or credit as determined by 117.10 includes all compensation for direct, indirect, and cumulative impact costs and no additional or other amounts for impact costs shall be allowed. The Contractor shall not assign any portion of the Work to another whereby the Contractor would benefit directly or indirectly from the double application of charges for overhead or profit. If no agreement can be reached between the Contractor and the City as to the cost or credit resulting from a change in the Work or the Contractor fails or refuses to sign a Change Order, the cost or credit shall be determined by the Authorized Representative, upon the recommendation of the Engineer. The Contractor shall proceed with the Change Order Work when so required by the Authorized Representative in writing. The Contractor may dispute the Authorized Representative's determination of the cost or credit by filing a claim in accordance with 118.01 through 118.11. The City reserves the right to require certified payrolls for labor costs and certified invoices for material costs, together with any other documentation the City deems in its sole discretion to be useful in analyzing the Contractor's claim and reserves the right to audit the records of the Contractor and the Contractor's Subcontractors and Material Suppliers. Failure by the Contractor to provide all requested documentation within 10 days shall constitute an irrevocable waive of Contractor's claim.

117.05 Change Order Procedures. The Contractor must be certain to comply with the applicable procedures or payment may be delayed or denied. The Engineer has responsibility for:

- (a) Preparing, reviewing, recommending, coordinating, monitoring and processing a Change Order and related documents;
- (b) Reviewing the Contractor's pricing within the stated time period, verifying the pricing complies with the pricing guidelines set forth in 117.10 and negotiating pricing, if necessary, to an amount acceptable to the City;
- (c) If the change is to have a not-to-exceed price based on performing the Work on a time and material basis or other cost-plus basis, monitoring the Contractor's progress toward completing the revised portion of the Work and requiring that the Contractor prepare daily records of additional labor, Materials and Equipment required along with a certification from the Contractor that the records are accurate and appropriate for the revised Work. The Engineer shall review these daily records and sign them, but solely for the purposes of signifying that the records are an accurate accounting of the items described therein, and provide a signed copy of the daily records to the Authorized Representative. The signed daily records are also to be attached to the Change Order. If the changed Work should cost less than the maximum amount noted on the Change Order, the Engineer is also responsible for preparing a deduct Change Order for the cost difference;
- (d) Reviewing and resolving the Contractor's request for an extension of time related to a Change Order in accordance with 116.01 through 116.06 and 117.12;
- (e) Confirming that the City concurs with the change and has available funds or a written commitment for funding the Change Order;

(f) Monitoring the overall Change Order process for timeliness and follow up.

The Contractor has responsibility for:

(a) Responding to requests for pricing within the stated time period;

(b) Preparing all necessary Proposals in sufficient detail for intelligent review with pricing and schedule impact, including those of all affected Subcontractors and Material Suppliers according to the pricing guidelines set forth in 117.10 or Unit Prices, as applicable, and negotiating pricing, if necessary;

(c) If the change is proposed to have a not-to-exceed price based on performing the Work on a time and material basis or other cost plus basis, furnishing and certifying detailed records of all labor, Materials and Equipment provided. If the changed Work should cost less than the maximum amount noted on the Change Order, the Contractor is also responsible for executing a deduct Change Order prepared for the cost difference;

(d) Proceeding with the Work upon receipt of a fully signed Change Order;

(e) If the Contractor performs Work without the appropriate, required Change Order, the Contractor does so at the Contractor's own risk that payment for such Work may not be approved or made, unless the City has required the Contractor to perform the Work in accordance with 117.03 and 117.04;

(f) Providing the changed Work in a timely manner and as authorized by the Change Order, all in accordance with the requirements of the Contract Documents; and

(g) Timely providing to Engineer and the Authorized Representative all requested backup documentation.

117.06 Change Order Process. When a change to the Work is ordered, the Engineer shall:

(a) Prepare an estimate of the cost of the changed Work and verify with the Authorized Representative that the change is ordered and that funds are available in the amount of the estimate for the Work;

(b) Prepare a detailed scope of Work in Bulletin form, including any necessary Drawings;

(c) Submit the Bulletin to the Authorized Representative for approval, along with a justification letter indicating the reason for the change in the Work;

(d) Upon receipt of approval by the Authorized Representative, release the Bulletin to the Contractor with a date specified for the Contractor to return a Proposal. If the Contractor fails to respond to the Engineer within the time specified, or as otherwise agreed to in writing by the Contractor and the Engineer, the Contractor shall be responsible for any additional costs incurred by the Contractor, the Engineer and the City resulting from any attendant delay;

(e) Review the Contractor's Proposal, verifying that pricing complies with the pricing guidelines set forth in 117.10 or Unit Prices, as applicable, and negotiate the price if required to obtain a price less than the maximum established by the pricing guidelines or different from the amount calculated using Unit Prices where appropriate. Within seven Days of receipt of the Contractor's Proposal, the Engineer shall notify the Contractor whether the Proposal is acceptable in form or advise the Contractor in writing of the reasons for disapproval. If negotiation of the price is necessary, any failure of the Contractor to respond appropriately and within the time specified, or as otherwise agreed to in writing by the Contractor and the Engineer shall cause the Contractor to be responsible for any additional costs incurred by the Contractor, the Engineer and the City resulting from any attendant delay;

(f) Determine the basis for pricing the Work and confirm whether the Work is for a fixed price, or for a not-to-exceed price based on performing the Work on a time and material basis, or other cost-plus basis. Verify that any Subcontractor and Material Supplier pricing is included and complies with the pricing guidelines set forth in 117.10 or Unit Prices, as applicable. Review any requested time extension with the Authorized Representative to be determined according to 116.01 through 116.06 and 117.12 and obtain written recommendation of approval of the Change Order from the Engineer and the applicable Director if other than the Engineer. Sign and obtain the Contractor's signature on the Change Order;

(g) Submit the Proposal to the Authorized Representative or the City Commission, as applicable, for approval along with the written recommendation of approval or disapproval of the Proposal of the City Engineer and other City Department head, if applicable;

(h) Deliver multiple copies of the signed Change Order package to the Authorized Representative for signing and any necessary fund certification. Upon signing by the Authorized Representative, the Authorized Representative shall return copies of the executed Change Order to the Contractor and the Engineer. The Contractor may bill for Work covered by the Change Order only after this final step.

117.07 Paperwork Consolidation. Related transactions occurring at or about the same time shall, whenever possible, be consolidated into the same Bulletin or Change Order, or both. Add and deduct items may be included on the same Change Order, as well as items with different reasons for changed Work so long as the reason and pricing for each item is separately stated.

117.08 Change Order Numbering System. Unless otherwise provided in the Contract Documents, the Engineer shall assign a number to each change which shall be stated on the Bulletin, starting with number 001. All Contractors affected by the change will be recorded under the same number. The Engineer will establish and maintain a Change Order log to track all activities related to Change Order processing and taking care not to duplicate or reuse any Change Order number throughout the Project.

117.09 Project Contingency Funds. Project Contingency Funds shall be reserved to pay costs resulting from Change Orders, unanticipated job conditions, to comply with rulings regarding building and other codes, to pay costs related to errors and omissions in Contract Documents, and to pay the cost of settlements and judgments related to the Project. Change

Orders for which there are sufficient moneys in the Contract price including the Project Contingency Funds must be approved by the Engineer and the Authorized Representative. Change Orders which would increase the Contract price must be approved by the City Commission.

117.10 Change Order Pricing Guidelines. For each change, the Contractor shall furnish a detailed, written Proposal itemized according to these pricing guidelines. Any Subcontractor or Material Supplier pricing shall also be itemized according to these pricing guidelines. Where Unit Prices were included in the Bid and the Contract price, the Engineer may also require incorporation of such Unit Prices or preparation of an Alternate Proposal incorporating such Unit Prices. These pricing guidelines are intended to establish the maximum amount which the City will pay for any Change Order, including without limitation all amounts for interference with, delay, hindrance, disruption or impact of the Work. A Change Order may provide that the City may pay less than the amount established by these pricing guidelines if such amount is negotiated by the Engineer in accordance with 117.06 or is determined in accordance with 118.01 through 118.11. As provided in 114.01 the Contract Cost Breakdown may be used by the City to determine any cost or credit. In order to expedite the review and approval process, all Proposals shall be prepared in the categories and in the order listed below. This provision is intended to be, and shall be construed as, consistent with, and not in conflict with, Section 4113.62, ORC to the fullest extent permitted. The pricing guidelines are:

- (a) **LABOR** - All field labor shall be priced at the current base rate, excluding fringe benefits, of the prevailing wage in the Project locality. The Proposal and documentation is to include number of hours and rate of pay for each classification of worker. If the Contractor pays an employee a base rate exceeding prevailing wage, the Contractor shall submit certified payroll records that substantiate that rate. Any Contractor performing Work on a time and material basis or the cost-plus basis Work shall submit certified payroll records for all employees performing that Work;
- (b) **FRINGES** - All established payroll taxes, assessments and fringe benefits on the labor. This may include, without limitation, FICA, Federal and State Unemployment, Health and Welfare, pension Funds, Workers' Compensation and Apprentice Fund. Each of the fringes is to be a separate line item. The Contractor shall submit documentation supporting the calculation of the amounts for each fringe for each worker classification;
- (c) **EQUIPMENT RENTALS** - All charges for certain non-owned heavy or specialized Equipment at up to one hundred percent of the documented rental cost. No rental charges will be allowed for hand tools, minor Equipment, simple scaffolds, etc. Downtime due to repairs, maintenance and weather delays will not be allowed. The Contractor shall submit copies of actual paid invoices to substantiate rental costs;
- (d) **OWNED EQUIPMENT** - All charges for certain owned, heavy or specialized Equipment at up to one hundred percent of the cost listed by the Associated Equipment Dealers Green book rental rates and Specifications for construction Equipment. No recovery will 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 will be the basis for the pricing. Downtime due to repairs, maintenance and weather delays will not be allowed;

(e) 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 will not be allowed;

(f) OVERHEAD - Overhead on items in 117.10 (a)-(d) up to ten percent, which shall include all costs required to schedule and coordinate the Work. Overhead includes, without limitation, telephone, telephone charges, facsimile, electronic mail, telegrams, postage, photos, photocopying, hand tools, simple scaffolds (1 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; provided, however, shop or engineering labor, which shall not be subject to prevailing wage rates, for steel Fabricators, sheet metal Fabricators and sprinkler system Fabricators will be allowed under 117.10 (a)-(d);

(g) MATERIALS - All Materials purchased by the Contractor and incorporated into the changed Work, showing costs, quantities, or Unit Prices of all items, as appropriate. Reimbursement of material costs shall only be allowed in the amount of the Contractor's actual cost, including any and all discounts, rebates or related credits. One-third of the cost of reusable Materials for each use, such as formwork lumber, shoring or temporary enclosures;

(h) PROFIT - Profit on items in 117.10 (a)-(g) up to ten percent;

(i) SUBCONTRACTOR - The reasonable cost of all labor and material provided by a Subcontractor whose pricing is included and which complies with these pricing guidelines;

(j) CONTRACTOR MARK-UP ON SUBCONTRACTOR - Mark-up on items in 117.10 (i) up to five percent or 2,500 dollars, whichever is less;

(k) MISCELLANEOUS - The following items are allowable as the cost of the Work, with no overhead or profit:

.1 Any additional bond or insurance premium specifically incurred as a result of the Change Order;

.2 Fees for permits, licenses, inspections, test, etc.; and

(l) Costs which will not be reimbursed for Change Order Work include the following:

.1 Overnight lodging, travel and food;

.2 Employee Profit Sharing Plans - regardless of how defined or described, the Contractor will pay these charges from Contractor profit and will not be reimbursed; and

.3 Voluntary Employee Deductions - examples are United Way and U.S. Savings Bonds.

(m) State sales tax shall be allowed on items as described in 104.18.

117.11 Differing Site Conditions. Subject to 103.06, during the progress of the Work, if subsurface or concealed conditions are encountered at the site differing materially from those indicated in the Contract Documents or if subsurface or concealed physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the Work provided for in the Contract Documents, are encountered at the site, the Contractor shall promptly notify the Engineer in writing of the specific differing conditions before they are disturbed or the affected Work is performed and if such notice is not possible, in no event later than 2 Business Days after Contractor first observed the conditions. Upon notification, the Engineer will investigate the conditions and if it is determined that the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of any Work under the Contract, a Change Order may be issued in accordance with the 117.01 through 117.12, as applicable. The City may decline to issue a Change Order if the notice required by this 117.11 is not timely provided by the Contractor. If the Contractor fails to timely provide the notice required by this 117.11, the Contractor shall be deemed to have waived any and all claims for additional compensation or time extensions for the related subsurface or concealed physical condition.

117.12 Time Extension. Notwithstanding any other provision of the Contract Documents, time extensions for changes in the Work will depend upon the extent to which the change causes delay in Work on the critical path of the Construction Schedule or if the Project involves multiple Contractors of the Project Schedule as determined pursuant to 109.06 and 109.05, respectively. If extending the time for Contract Completion is not possible, the Contractor shall price, and separately state, all costs of accelerated performance in the Contractor's Proposal. A Change Order granting a time extension may provide that the time for Contract Completion will be extended for only those specific elements actually delayed and that remaining milestone completion dates will not be altered and may further provide for adjustment of Liquidated Damages, to the fullest extent permitted by law. The Contractor shall not be entitled to any time extensions for delays caused by Contractor, its subcontractors, suppliers, normal weather conditions for the time of year and locality, or abnormal weather conditions that do not affect the critical path.

ITEM 118 DISPUTE RESOLUTION PROCEDURE

118.01 Notice and Claim Requirements

118.02 Filing of Notice

118.03 Filing of Claim

118.04 Claim Response

118.05 Claim Review and Decision

118.06 Appeal to Board of Review

118.07 Alternate Dispute Resolution

118.08 Delegation

118.09 Auditing of Claims

118.10 False Certification of Claims

118.11 Performance and Payment

118.01 Notice and Claim Requirements. Whenever the Contractor intends to seek additional time or compensation or mitigation of Liquidated Damages, whether due to delay, extra Work, additional time or Work, breach of Contract, or other causes arising out of or related to the Contract or the Project, the Contractor shall follow the procedures set forth in 118.01 through 118.11. The Contractor acknowledges and agrees that the Owner may delay, interfere with, and/or disrupt the Work of the Contractor, and such actions do not constitute a material breach of contract by the Owner, since the Contractor is entitled to additional compensation by properly submitting and pursuing a Claim as permitted by these Specifications. To the fullest extent permitted by law, failure by the Contractor to follow the procedures in 118.01 through 118.11 is a waiver of any claim for additional time or compensation or for mitigation of Liquidated Damages. Compliance with all applicable procedures in 118.01 through 118.11 is a condition precedent to the filing by the Contractor of any litigation related to the Contract or the Project.

118.02 Filing of Notice. Unless a shorter notice period is provided elsewhere in this Agreement, the Contractor shall file notice of any claim with the Engineer, in writing, no more than ten Days after the initial occurrence of the events, which are the basis of the claim. To the fullest extent permitted by law, failure of the Contractor to timely and completely provide such notice shall constitute a waiver by the Contractor of any claim for additional time or compensation or for mitigation of Liquidated Damages. Every such written notice shall provide the following information to permit timely and appropriate evaluation of the claim, determination of responsibility and opportunity for mitigation:

- (a) Nature of claim and estimated amount of the claim, including all costs for interference, disruption, hindrance, delay and any impact, which amount shall be calculated in accordance with the pricing guidelines set forth in 117.10, shall be based upon the Contractor's experience and shall be a fair and reasonably accurate assessment of the damages suffered or anticipated by the Contractor, as applicable;
- (b) Specific number of Days of extension requested and specific number of Days for remobilization requested;
- (c) Identification of Persons and events responsible for causing the claim, including without limitation the date or anticipated date, as applicable of the commencement of any interference, disruption, hindrance, delay or impact;

- (d) Identification of activities on the Construction Schedule and the Project Schedule, if applicable, which will or may be affected by the claim or new activities which will or may be created and the relationship with existing activities;
- (e) Anticipated impacts and anticipated duration of any interference, disruption, hindrance, delay or impact and any remobilization period; and
- (f) Recommended action to avoid or minimize any interference, disruption, hindrance, delay or impact.

118.03 Filing of Claim. With respect to every claim submitted, the Contractor shall file three copies of its claim with the Engineer not more than thirty Days after the notice required by 118.02 and, in all events prior to Contract Completion. The Contractor's claim shall detail the amounts claimed and provide the following information to permit timely and appropriate evaluation of the claim, determination of responsibility and any remaining opportunity for mitigation. If the Contractor is unable to calculate any amount claimed in detail, the Contractor shall use its best efforts to provide a reasonable estimate of such amount:

- (a) A narrative of the event, or combination of events, claimed as resulting in interference, disruption, hindrance, delay or impact to the Contractor, including the start date of the event or events and the actual, or anticipated, finish date;
- (b) A quantification of the planned Work items and the changed scope of Work items claimed as having been impacted;
- (c) A time impact analysis, consistent with standard critical path methodology for scheduling, demonstrating the impact to the Contractor's scheduled activities;
- (d) Copies of the Contractor's daily log for each Day of impact;
- (e) Copies of relevant correspondence and other information regarding or supporting Contractor entitlement;
- (f) Copies of Contractor payroll records for labor impacts claimed by Contractor and any Subcontractor affected by the event or events;
- (g) Copies of invoices for material impacts claimed by the Contractor and any Subcontractor affected by the event or events;
- (h) Copies of Equipment records, or rental invoices, for any Equipment impacts claimed by the Contractor or any Subcontractor affected by the event or events;
- (i) Copies of the most recent Contractor's 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;
- (j) A copy of Contractor's original coded bid takeoff and estimating records that formed the basis of Contractor's bid;

(k) Contractor's coded Job Cost Report with a key to the coding;

(l) A statement, signed by an authorized representative of the Contractor, certifying that the claims are made in good faith, the supporting data is accurate and complete to the best of the Contractor's knowledge and belief and the amount requested accurately reflects the Contract adjustment for which the Contractor believes the City is liable in accordance with the Contract Documents, in particular the pricing guidelines set forth 117.10.

The City may request documents and information from the Contractor in addition to those listed in this 118.03, as the City determines necessary to evaluate and comment upon the Claim. Upon receipt of such request from the Owner, the Contractor shall provide all requested documents and information within ten (10) days. The Contractor shall provide the requested documents in the formats requested, which include both paper and electronic copies. If requested by the City, the electronic copies shall be provided in native computer language. The Contractor's provision of the requested documents to the City in the format requested by the City shall be a condition precedent to any further proceeding under the Contract Documents. Failure to provide the requested documents shall be a material breach of the Contract, and the Contractor shall indemnify the City for all of the City's costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the Contractor's failure to comply with this provision. If the Contractor fails to provide the requested documents, the Contractor shall be deemed to have irrevocably waived its claim.

118.04 Claim Response. Immediately upon receipt of any claim submitted by the Contractor in accordance with 118.03, the Engineer shall deliver 2 copies to the Authorized Representative. Upon submission of the claim by the Contractor, the Engineer shall convene a meeting with the Contractor and any applicable Subcontractors and Material Suppliers to review and discuss the claim. The Engineer shall review the Contractor's claims with all attendees and discuss any questions regarding the nature or content of the required items. Any items deemed deficient shall be corrected by the Contractor before the Engineer will commence review in accordance with 118.05. The Engineer shall document the timeliness of notice provided under paragraph 118.02 and the actual date of corrected submission of the claim.

118.05 Claim Review and Decision. Upon corrected submission of the claim and all requested documentation by the Contractor, the Engineer shall review the claim and prepare a written analysis of its content. The analysis may include a narrative of the examination of the facts giving rise to the claim, relevant Contract Documents and language therein, an analysis of claimed additional labor, Materials and Equipment for the scope of the Work items described and an analysis of any time extension for any interference, disruption, hindrance, impact or delay claimed (including the calculation of any concurrent delays affecting entitlement) and shall include confirmation of the calculation of claimed labor, Materials and Equipment as conforming to the pricing guidelines set forth in 117.10 and a concluding recommendation regarding Contractor entitlement to, and the appropriateness and reasonableness of, all or any part of, the claimed costs and time extension. The Engineer may include copies of contemporaneous documentation supporting any recommendation regarding the sufficiency or inadequacy of the Contractor's claim, the Contractor's performance or the rebuttal of the claim. The Engineer shall prepare and submit the claim analysis to the Authorized Representative within thirty Days of the corrected

submission of the claim. The Authorized Representative shall examine the Contractor's claim, and the analysis of the claim submitted by the Engineer. The Authorized Representative shall approve or deny all or any part of, the Contractor's claim and forward a written decision to the Contractor and the Engineer within thirty Days after receipt of the Engineer's claim analysis. The decision of the Authorized Representative shall be final and conclusive, unless the Contractor appeals the decision to the Board of Review in accordance with 118.06. In the event either the Engineer or the Authorized Representative fail to act in accordance with the foregoing schedule, the claim shall be deemed denied.

118.06 Appeal to Board of Review. The Contractor may appeal the decision of the Authorized Representative to the Board of Review by written notice to the Authorized Representative within ten Days of receipt of the Authorized Representative's decision or, in the absence of a decision, within 10 days of the expiration of the time set forth in 118.05. Failure by the Contractor to provide notice of an appeal within the said 10-day period shall result in the Engineer's decision becoming final and binding upon the Contractor. The Board of Review shall meet within thirty Days of receipt of the notice by the Authorized Representative. The Contractor shall be given an opportunity to present the claim at the meeting. The purpose of the meeting shall be to settle the issues in dispute. The Board of Review shall render a decision on the claim within thirty Days of the meeting unless a mutual agreement is made between the Contractor and the Board of Review to extend the time for decision. The decision of the Board of Review shall be final and conclusive, unless the Contractor provides written notice to the Authorized Representative of the Contractor's intention to file litigation within ten Days of receipt of the decision. The filing of an appeal and the provision of notice of intention to file litigation are each a condition precedent to the filing of any litigation related to the Project or the Contract by the Contractor and any failure by the Contractor to timely fulfill them will preclude the Contractor from filing any such litigation.

118.07 Alternate Dispute Resolution. If, upon consideration of a claim, the Contractor and the City mutually agree in writing, the dispute resolution procedure may be waived, or the claim may be referred to a form of Alternative Dispute Resolution, including a procedure to equitably share the costs of the Alternative Dispute Resolution.

118.08 Delegation. No provision shall prevent the Board of Review or the Authorized Representative from delegating the duties or authorities of the Board of Review or the Authorized Representative to any third Person selected at the discretion of the Board of Review or Authorized Representative, as applicable.

118.09 Auditing of Claims. All claims by the Contractor shall be subject to audit at any time following the filing of such claim, whether or not such claim is part of litigation pending in the courts of this State. The audit may be performed by employees of the City or by a consultant engaged by the City. The audit may begin on ten Days' notice to the Contractor, Subcontractor or Material Supplier, as applicable. The Contractor, Subcontractor or Material Supplier shall use its best efforts to cooperate with the audit. Failure of the Contractor, Subcontractor or Material Supplier to maintain and retain sufficient records to allow the City to verify the claim shall constitute a waiver of any portion of such claim that cannot be verified. Without limiting the foregoing, and as a minimum, the Contractor, Subcontractor or Material Supplier shall make available to the City the following documents:

- (a) Daily time sheets and foreperson's daily reports;
- (b) Union agreements, if any and employer agreements;
- (c) Insurance, welfare, fringes and benefits records;
- (d) Payroll register;
- (e) Earnings records;
- (f) Payroll tax returns;
- (g) Material invoices, purchase orders, Subcontractor Contracts and all material and supply acquisition Contracts;
- (h) Material cost distribution worksheets;
- (i) Equipment records (list of Contractor Equipment, rates, etc.);
- (j) Vendor rental agreements, and Subcontractor invoices;
- (k) Subcontractor payment certificates;
- (l) Canceled checks (payroll and vendors);
- (m) Job cost reports;
- (n) Job payroll ledger;
- (o) 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;
- (p) Cash disbursements journal;
- (q) Financial statements for all years reflecting operations on the Project;
- (r) Income tax returns for all years reflecting operations on the Project;
- (s) Depreciation records on all Equipment utilized whether such records are maintained by the Contractor involved, its accountant, or others;
- (t) 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 such other source documents;
- (u) All documents which reflect the Contractor's actual profit and overhead, or the calculation of overhead multipliers, during the years the Project was being performed and for each of the five years prior to the commencement of this Project;

(v) All documents related to the preparation of the Contractor's Bid, including the contemporaneous final calculations on which the Bid was based;

(w) All documents which relate to each and every claim together with all documents which support or negate the amount of damages as to each claim;

(x) 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 which establish the time periods, individuals involved, the hours and rate of pay for the individuals; and

(y) All other documents required by the City in its discretion to intelligently review the claim.

118.10 False Certification of Claims. The Contractor shall not knowingly present or cause to be presented to the Owner a false or fraudulent Claim. "Knowingly" shall have the same meaning as in Section 3729(b) USC of the Federal False Claims Act. If the Contractor knowingly presents or causes to be presented a false or fraudulent Claim, then the Contractor shall be liable to the Owner for the same civil penalty and damages as the United States Government would be entitled to recover under such Section 3729(a) USC and shall also indemnify and hold the City harmless from all costs and expenses, including the City's attorneys' and consultants' fees and expenses incurred in investigating and defending against such Claim and in pursuing the collection of such penalty, damages, and fees and expenses. If any Contractor falsely certifies all or any part of a claim, the portion of the claim so certified shall be denied. If any Contractor is found to have falsely certified all or any part of any claim, that fact may be used to support a finding of ineligibility in future Bids for the award of any City Contract.

118.11 Performance and Payment. The Contractor shall proceed with performance of the Work during any dispute resolution process, unless otherwise agreed by the Contractor and the Authorized Representative in writing. The City 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 the Authorized Representative in writing. If the Contractor accepts the decision of the Authorized Representative or the City Commission and foregoes litigation of the claim, any payment to be made, credit to be provided or extension of time to be granted pursuant to the decision shall be evidenced by a Change Order package consisting of a completed Change Order form signed by the Contractor, the Engineer and the Authorized Representative, a copy of the approval of the City Commission and any necessary supporting documentation and any payment shall be made pursuant to a Payment Request in accordance with 114.02 and 114.03 or 114.10 through 114.13, as applicable.

118.12 Settlement Offers. If the Contractor initiates a Claim, the City may make settlement offers to settle the Claim at any time up to the date of the trial. Such settlement offers shall be subject to Rule 408 (Compromise and Offers of Compromise) of the Ohio Rules of Evidence. If at any stage of the litigation, including any appeals, the Contractor's Claim is dismissed or found to be without merit, or if the damages awarded to the Contractor on its Claim do not exceed the City's last settlement offer, the Contractor shall be liable to the City and shall reimburse the City for all of the City's attorneys' fees and expenses, and arising out of or related to such Claim since the date of such last settlement offer.

ITEM 119 CONTRACT TERMINATION

119.01 Notice to Surety

119.02 Suspension of Work

119.03 Termination for Convenience

119.04 Termination for Cause

119.05 Contractor Bankruptcy

119.01 Notice to Surety. The Authorized Representative shall provide notice to the Contractor's Surety of any Suspension or Termination pursuant to 119.01 through 119.05; provided, however, the failure to provide such notice shall not release the Surety from any of its obligations.

119.02 Suspension of Work. If, in the judgment of the Authorized Representative, the Contractor is causing undue risk of damage to any part of the Project or adjacent area, the Authorized Representative may suspend the Work temporarily, either wholly or in part, for such period until, in the judgment of the Authorized Representative, the safe and proper prosecution of the Work may be resumed. The Authorized Representative may also suspend the Work either in whole or in part for a specified number of Days on account of public necessity, adverse weather conditions, or other similar reasons which are beyond the control of the Contractor. In case of such a suspension, an extension of time, if appropriate, may be allowed as provided in the Contract Documents but no payment will be made to the Contractor for any expense or damages resulting therefrom, except where Contractor has established that a delay was proximately caused by an improper action or failure to act by the Owner, in which case Contractor may be entitled to additional compensation. Any failure of the Authorized Representative to suspend the Work shall not relieve the Contractor of the Contractor's responsibility to perform the Work safely and in accordance with the Contract Documents. The Contractor shall, upon receipt of notice of suspension, cease Work on the suspended activities and take all necessary or appropriate steps to limit disbursements and minimize costs with respect thereto. The Contractor shall furnish a report to the Authorized Representative, within five Days of receipt of the notice of suspension, describing the status of the Work, including without limitation, results accomplished, conclusions resulting therefrom, and such other information as the Authorized Representative may require. In the event of suspension, the Contractor shall be entitled to payment of compensation due under the Contract Documents, upon submission of a proper invoice, for the Work performed prior to receipt of notice of suspension, which shall be payable based upon the Contract Cost Breakdown.

119.03 Termination for Convenience. The City may, at any time upon seven Days written notice to the Contractor, terminate the Contract in whole or in part for the City's convenience and without cause. Upon receipt of the notice of termination for convenience, the Contractor shall immediately, in accordance with instructions from the Authorized Representative, proceed with performance of the following duties:

(a) Cease operation as specified in the notice;

(b) 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;

- (c) Terminate all subcontracts and orders to the extent they relate to the Work terminated;
- (d) Proceed to complete the performance of any Work not terminated; and
- (e) Take actions that may be necessary, or that the Authorized Representative may require, for the protection and preservation of the terminated Work.

Upon termination for convenience, the Contractor shall be paid in accordance with the Contract Cost Breakdown for Work completed, including any amount retained, and the value of Materials ordered and delivered, less any salvage credit the Contractor may receive for them. All Materials, Equipment, facilities and supplies at the Project site, or stored off site, for which the Contractor has been compensated, shall become property of the City. The Contractor may submit evidence of any reasonable expenses directly attributable to the termination of the Work for consideration by the City. The Contractor shall not be entitled to any profit or overhead for Work not performed and in no event shall the Contractor's compensation exceed the total Contract price. Any dispute as to the sum then payable to the Contractor shall be resolved in accordance with the provisions of 118.01 through 118.11.

119.04 Termination for Cause. If the City determines that the Contractor has failed to prosecute the Work with the necessary force or in a timely manner; failed to make payments to Subcontractors or Suppliers pursuant to the agreements between the Contractor and Subcontractors or Suppliers; disregards any applicable laws, statutes, ordinances, codes, rules, regulations, or lawful orders of a public authority; has refused to remedy any Defective Work; or is otherwise in substantial breach of the Contract Documents, the Authorized Representative shall notify the Contractor and the Contractor's Surety of such failure or refusal. The Contractor shall begin to cure such failure or refusal within two Business Days of receipt of the notice. If the Contractor fails to continuously and diligently pursue and cure such failure or refusal within twenty Days of receipt of the notice, the City may, without prejudice to any of its other rights or remedies, terminate the Contract and employ upon the Work the additional force, or supply the Materials or such part of either as is appropriate, and may remove Defective Work. If the Contractor is so terminated, the Contractor's Surety may be given the option to engage another Contractor to perform the Contract, with the approval of the Authorized Representative. If the Contractor's Surety does not commence performance of the Contract within ten Days of the date on which the Contract was terminated, the City may complete the Work by such means as the Authorized Representative deems appropriate. The City may take possession of and use all Materials, facilities, and Equipment at the Project site or stored off site for which the City has paid. If the Contract is so terminated, the Contractor shall not be entitled to any further payment. If the City completes the Work and if the cost of completing the Work exceeds the balance of the Contract price, including compensation for all direct and consequential damages incurred by the Engineer and/or the City as a result of the termination, such excess shall be paid by the Contractor or the Contractor's Surety. If the Contractor's Surety performs the Work, the provisions of the Contract Documents shall govern the Surety's performance, with the Surety being substituted for the Contractor in all such provisions including, without limitation, provisions for payment for the Work and provisions about the right of the City to complete the Work. Upon a final determination, by a court of competent jurisdiction, that the termination pursuant to 119.04 was improper, the termination shall be deemed a termination for convenience pursuant to 119.03.

119.05 Contractor Bankruptcy. If the Contractor files a voluntary petition in bankruptcy or has an involuntary petition in bankruptcy filed against the Contractor, or 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 Authorized Representative shall serve written notice on the Contractor and the Contractor's Surety stating that any failure of the Contractor to provide adequate assurances of continued performance will be considered a rejection of the Contract, which shall result in termination of the Contract for cause. In such event, Surety shall be immediately responsible for timely and property completion of the Work. Such termination of the Contract need not be evidenced by an order of any court rejecting the Contract. Upon a final determination, by a court having jurisdiction, that the termination was improper, the termination will be deemed to be a termination for convenience pursuant to 119.03.

ITEM 120 - AUDITS AND RECORDS

120.01 Examination

120.02 Termination and Disputes

120.03 Non-Disclosure by Contractor

120.04 Interest

120.01 Examination. The City shall have the right to examine all books, records, documents and other data of the Contractor and of the Contractor's Subcontractors and Material Suppliers related to the Bidding, pricing, or performance of the Work, including without limitation for the purpose of evaluating any Proposal or claim. Such Materials shall be made available at the office of the Contractor, Subcontractor, or Material Supplier, as applicable, at all reasonable times for inspection, audit and reproduction until the expiration of seven years after the date of Final Acceptance of the Project by the City. To the extent that the Contractor, Subcontractor, or Material Supplier, as applicable, informs the City in writing that any documents copied by the City are trade secrets, the City shall treat such documents as trade secrets of the Contractor, Subcontractor, or Material Supplier, as applicable. In the event, any dispute arises with any other Person about whether such other Person should be given access to the documents, the Contractor, Subcontractor, or Material Supplier, as applicable, agrees to indemnify the City against all costs, expenses and damages, including without limitation attorneys' fees, incurred or paid by reason of such dispute. The right of inspection, audit, and reproduction shall extend to all documents necessary to permit adequate evaluation of the cost of pricing data submitted along with the computations and Projections used therein.

120.02 Termination and Disputes. If the Contract has been terminated, in whole or in part, the records relating to the Work terminated shall be made available to the City for a period of seven years from the date of any applicable final settlement or payment, as applicable. Records which relate to disputes, litigation, or settlement of claims arising out of the performance of the Work shall be made available until such dispute, litigation or settlement has been finally decided or settled.

120.03 Non-Disclosure by Contractor. The Contractor shall not disclose, at any time during or after the Work, either directly or indirectly, any confidential records, knowledge or information which the Contractor may acquire about the Project or the City, except as may be required by law or order of a court of competent jurisdiction.

120.04 Interest. Moneys owed to the Contractor by the City pursuant to the terms of the Contract Documents, which are not paid when due shall accrue straight interest at the rate paid by the STAR Account, from the date the moneys become due until the moneys are paid. Any contrary provisions of 153.12, 153.13, 153.14 and 153.63, ORC, do not apply to this Contract.

SUPPLEMENTAL SPECIFICATIONS FOR WATER QUALITY LAB EXPANSION

All work shall be in conformance with the City of Dayton, Construction and Material Specifications (Latest Edition) except as supplemented or modified herein.

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6. Build America, Buy America (BABA) Acknowledgement
7. American Iron and Steel Acknowledgement
8. WPCFL/WSRLA Contract Change Order Form

ITEM	DESCRIPTION
103	INSTRUCTIONS TO BIDDERS

Section 103.07 Pre-Bid Meeting. The following paragraph is hereby added to the Specification:

A MANDATORY pre-bid conference, for all Prime Contractors, will be held at 11:00 o'clock am, Dayton time, Tuesday, March 10, 2026, at 3210 Chuck Wagner Lane, Dayton, Ohio in the Miami Water Treatment Plant Conference Room.

Section 103.46 Notice of EPA Funding Requirements is hereby added to the Specifications:

This project is being funded by a U.S. Environmental Protection Agency (EPA) Grant. This source of funding requires modifications to the Specifications. The requirements are included within the Supplemental Specifications.

Section 103.47 Small Businesses in Rural Areas is hereby added to the Specifications:

This procurement is subject to the EPA policy of encouraging the participation of small businesses in rural areas. It is EPA policy that recipients of EPA financial assistance awards utilize the services of small businesses in rural areas (SBRAs), to the maximum extent practicable. The objective is to assure that such small business entities are afforded the maximum practicable opportunity to participate as subcontractors, suppliers and otherwise in EPA-awarded financial assistance programs. This policy applies to all contracts and subcontracts for supplies, construction, and services under EPA grants or cooperative agreements. Small purchases are also subject to this policy.

ITEM	DESCRIPTION
104	GENERAL REQUIREMENTS

Section 104.19 EPA Funding Requirements is hereby added to the Specification:

104.19a Disadvantaged Business Enterprises (DBE)

1. The prime contractor must pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the owner.
2. The prime contractor must notify the owner in writing prior to the termination of any Disadvantage Business Enterprise subcontractor for convenience by the prime contractor.
3. If a Disadvantage Business Enterprise contractor fails to complete work under the subcontract for any reason, the prime contractor must employ the six Good Faith Efforts (listed below) if soliciting a replacement contractor.
4. The prime contractor must employ the six Good Faith Efforts even if the prime contractor has achieved its fair share objectives.
5. An owner must ensure that each procurement contract it awards contains the following terms and conditions:
The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies.

104.19b Davis-Bacon Wage Rate Requirements

As used in these provisions "subrecipient" means City of Dayton.

(a) The following applies to any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1.

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH- 1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, www.wdol.gov.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination, and which is to be employed under the contract shall be classified in conformance with the wage determination. The EPA award official shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
- (2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the subrecipient(s) to the State award official. The State award official will transmit the report, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the questions, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account asset for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain

written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the subgrant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead, the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio

permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(b) Contract Work Hours and Safety Standards Act. The following applies to any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. As used in these paragraphs, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section. (3) Withholding for unpaid wages and liquidated damages. The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

104.19c Build America, Buy America (BABA) Requirement

Buy America Preference. Recipients of an award of Federal financial assistance from a program for infrastructure are hereby notified that none of the funds provided under this award may be used for an infrastructure project unless:

(1) All iron and steel used in the project are produced in the United States—this means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;

(2) All manufactured products used in the project are produced in the United States— this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard that meets or exceeds this standard has been established under applicable law or regulation for determining the minimum amount of domestic content of the manufactured product; and

(3) All construction materials are manufactured in the United States—this means that all

manufacturing processes for the construction material occurred in the United States. The construction material standards are listed below.

Incorporation into an infrastructure project. The Buy America Preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America Preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of the structure or permanently affixed to the infrastructure project.

Categorization of articles, materials, and supplies. An article, material, or supply should only be classified into one of the following categories: (i) Iron or steel products; (ii) Manufactured products; (iii) Construction materials; or (iv) Section 70917(c) materials. An article, material, or supply should not be considered to fall into multiple categories. In some cases, an article, material, or supply may not fall under any of the categories listed in this paragraph. The classification of an article, material, or supply as falling into one of the categories listed in this paragraph must be made based on its status at the time it is brought to the work site for incorporation into an infrastructure project. In general, the work site is the location of the infrastructure project at which the iron, steel, manufactured products, and construction materials will be incorporated.

Application of the Buy America Preference by category. An article, material, or supply incorporated into an infrastructure project must meet the Buy America Preference for only the single category in which it is classified.

Determining the cost of components for manufactured products. In determining whether the cost of components for manufactured products is greater than 55 percent of the total cost of all components, use the following instructions:

- (a) For components purchased by the manufacturer, the acquisition cost, including transportation costs to the place of incorporation into the manufactured product (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or
- (b) For components manufactured by the manufacturer, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (a), plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the manufactured product.

Construction material standards. The Buy America Preference applies to the following construction materials incorporated into infrastructure projects. Each construction material is followed by a standard for the material to be considered "produced in the United States." Except as specifically provided, only a single standard should be applied to a single construction material.

- (1) Non-ferrous metals. All manufacturing processes, from initial smelting or melting through final shaping, coating, and assembly, occurred in the United States.
- (2) Plastic and polymer-based products. All manufacturing processes, from initial combination of constituent plastic or polymer-based inputs, or, where applicable, constituent composite materials, until the item is in its final form, occurred in the United States.
- (3) Glass. All manufacturing processes, from initial batching and melting of raw materials through annealing, cooling, and cutting, occurred in the United States.
- (4) Fiber optic cable (including drop cable). All manufacturing processes, from the initial ribboning (if applicable), through buffering, fiber stranding and jacketing, occurred in the United States. All manufacturing processes also include the standards for glass and optical fiber, but not for nonferrous metals, plastic and polymer-based products, or any others.
- (5) Optical fiber. All manufacturing processes, from the initial preform fabrication stage through the completion of the draw, occurred in the United States.
- (6) Lumber. All manufacturing processes, from initial debarking through treatment and planing, occurred in the United States.
- (7) Drywall. All manufacturing processes, from initial blending of mined or synthetic gypsum plaster and additives through cutting and drying of sandwiched panels, occurred in the United States.

States.

(8) Engineered wood. All manufacturing processes from the initial combination of constituent materials until the wood product is in its final form, occurred in the United States.

Waivers. When supported by rationale provided in IIJA §70914, the recipient may submit a waiver request in writing to EPA. Recipients should request guidance on the submission instructions of an EPA waiver request from the EPA Project Officer for this agreement. A list of approved EPA waivers (general applicability and project specific) is available on the EPA Build America, Buy America website.

EPA may waive the application of the Buy America Preference when it has determined that one of the following exceptions applies:

- (1) applying the Buy America Preference would be inconsistent with the public interest;
- (2) the types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or
- (3) the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent.

For questions regarding the Build America, Buy America Act requirements for this assistance agreement or to determine if there is an approved waiver in place, please contact the EPA Project Officer for this agreement.

Definitions. For legal definitions and sourcing requirements, the recipient must consult the EPA Build America, Buy America website, 2 CFR Part 184, and the Office of Management and Budget's (OMB) Memorandum M-24-02 Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure.

104.19d Signage

The Contractor is required to place a physical sign displaying the EPA logo at the construction site for this project in an easily visible location that can be directly linked to the work taking place. The sign must be maintained in good condition throughout the construction period. In cases where the construction site covers a large area (e.g., lead service line replacement or septic tank repair/replacement projects), a sign should be placed in an easily visible location near where the work is being performed (e.g., entrance to the neighborhood, along a main road through town, etc.). Signage costs are considered an allowable grant expense, provided the costs associated with the signage are reasonable. Additionally, to increase public awareness of projects serving communities where English is not the predominant language, assistance recipients are encouraged to translate the language on signs (excluding the EPA logo or seal) into the appropriate non- English language(s). The costs of such translation are allowable grant expenses, provided the costs are reasonable.

Procuring Signs: Consistent with section 6002 of RCRA, 42 U.S.C. 6962, and 2 CFR 200.323, recipients are encouraged to use recycled or recovered materials when procuring signs.

EPA Logo: The Contractor will ensure that signage displays the EPA logo. The EPA logo must not be displayed in a manner that implies that EPA itself is conducting the project. Instead, the EPA logo must be accompanied with a statement indicating that the recipient received financial assistance from EPA for the project.

The Contractor will ensure compliance with the sign specifications provided by the EPA Office of Public Affairs (OPA) available at: <https://www.epa.gov/grants/epa-logo-seal-specifications-signage-producedepa-assistance-agreement-recipients>. As provided in the sign specifications from OPA, the EPA logo is the preferred identifier for assistance agreement projects and use of the EPA seal requires prior approval from the EPA. To obtain the appropriate EPA logo or seal graphic file, the recipient should send a request directly to Londa Scott-Forte (202-564-1504) and Jini Ryan (202-564-1075). Please explain in the message that the EPA logo is to be used on signage at a construction site funded with EPA assistance and copy the EPA Project Officer on the message.

104.19e Violating Facilities

The Contractor agrees to comply with all applicable standards, orders or requirements under Section 306 of the Clean Air Act, 42 USC 1857 (h), Section 508 of the Clean Water Act, 33 USC 1368, Executive Order 11738, and EPA regulations, 40 CFR Part 32, which prohibits the use under non-exempt Federal contracts, grants, or loans of facilities included on the EPA List of Violating Facilities.

104.19f Insurance Provisions

The Contractor shall, at his expense, furnish and maintain insurance in the form and amounts specified in subparagraphs 1 through 7, inclusive, of this section. Policies shall be with acceptable insurance companies authorized to do business in the State of Ohio.

The Contractor shall not commence Work nor shall he permit any of his Sub-contractors to commence Work until the insurance policies specified hereinafter, or otherwise required, have been submitted to, and approved by the Owner. Such insurance policies shall be kept in force until the Contractor receives final payment.

Insurance shall be endorsed so that it cannot be changed or canceled in less than ten (10) days after receipt by the Contractor and the Owner of written notice of such proposed action from the Insurer.

The insurance specified in Subparagraphs 1, 2, 3 and 4 shall be written under the comprehensive general form of liability insurance contracts.

The Contractor shall furnish three (3) certificates or, whenever specifically requested by the Owner, three (3) certified copies of the insurance policies themselves and a receipt evidencing full payment of the premiums.

In addition to the insurance described hereinafter, the Contractor shall secure and maintain such other insurance as may be designated elsewhere in the Contract document.

If the Contractor is required to repair or perform Work after the completion of the Work involved under this Contract or obtain new policies in accordance with the requirements in this section.

1. Builders Risk: In addition to such fire and other physical damage insurance as the Contractor elects to carry for his own protection, he shall also secure and maintain in the name of the Owner, the government agency sponsoring the Project, Subcontractors, the Consulting Engineer and any other parties having an interest in the Project, as named insured as their interest may appear; a builders' risk policy for fire, extended coverage, vandalism and malicious mischief in the amount of one hundred (100) percent of the value of the complete parts of the Project and Materials in storage, except that such coverage shall not be required in connection with sewer, water main or paving construction. Pump or lift station construction shall not be considered sewer or water main construction for purposes of this paragraph.

2. Workers Compensation: The Contractor shall provide Workers Compensation Insurance for all employees engaged in Work who may come within the protection of the workers compensation law, and, where applicable, employer's General Liability Insurances for employees not so protected and shall require all Subcontractors to provide corresponding insurance.

The Contractor shall indemnify the Owner and the Consulting Engineer against any and all liabilities, cost and expenses due to accidents or other occurrences covered by the workers compensation law.

3. Contractor's Motor Vehicle Bodily Injury and Property Damage Liability Insurance: Insurance to cover liability arising from the use and operation of motor vehicles in connection with the performance of the Contract (as customarily defined in liability insurance policies), whether they be owned, hired or non-owned by the Contractor, as follows:

- a. Bodily Injury Liability: \$500,000 for each person; limit of \$1,000,000 for each occurrence.
- b. Property Damage Liability: \$500,000 for each occurrence.

4. Contractor's Public Liability and Property Damage Liability Insurance: Contractor's Public Liability Insurance providing a limit of not less than \$500,000 for all damages arising out of bodily injuries, including accidental death to one person, and a total limit of \$1,000,000 for all damages arising out of bodily injuries, including accidental death, to two or more persons in any one occurrence. Contractor's Property Damage

Liability Insurance providing for a limit on not less than \$500,000 for all damages to or destruction of property.

Coverage under this policy shall include, to the limits indicated above, the collapse or damage to any structure, building or its contents, public or private utility, or pavement during construction and for two (2) years thereafter.

Whenever Work under the Contract is to be done in the vicinity of existing underground utilities or structures, coverage under the policy shall also include, to the limits indicated, all damages to said underground utilities or structures during construction and for a period of two (2) years thereafter. Whenever Work under the Contract is to be done by blasting, coverage under the policy shall also include, to the limits indicated above, all damages of any kind whatsoever caused by blasting.

5. Contractor's Protective Public Liability and Property Damage Liability Insurance: Contractor's Protective Public Liability and Property Damage Liability Insurance for operations performed by Subcontractors providing for coverage and limits corresponding to those described in subparagraph 4.

6. Owner's Protective Public Liability and Property Damage Liability Insurance: Regular Owner's Protective Public Liability and Property Damage Liability Insurance for operations performed by the Contractor or any Sub-contractor providing for coverage and limits corresponding to those described in subparagraph 4.

This policy shall be written in the name of the Owner as a separate policy from those specified elsewhere herein.

104.19g Materials Testing

1. Contractor shall appoint, employ, and pay for specified services of an independent firm to perform testing.
2. The independent firm will perform tests and other services specified in individual specification sections and as required by the Architect/Engineer.
3. Testing and source quality control may occur on or off the project site. Perform offsite testing as required by the Architect/Engineer or the Owner.
4. Reports will be submitted by the independent firm to the Architect/Engineer and Contractor, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
5. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
 - a. Notify Architect/Engineer and independent firm 24 hours prior to expected time for operations requiring services.
 - b. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
6. Testing does not relieve Contractor of performing Work to contract requirements.
7. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Architect/Engineer. Payment for retesting will be charged to the contractor by deducting testing charges from the Contract Sum/Price.

104.19h Prohibition on Telecommunications and Video Surveillance

As required by 2 CFR 200.216, EPA recipients and subrecipients, including borrowers under EPA funded revolving loan fund programs, are prohibited from obligating or expending loan or grant funds to procure or obtain; extend or renew a contract to procure or obtain; or enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that use covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE

Corporation (or any subsidiary or affiliate of such entities). Recipients, subrecipients, and borrowers also may not use EPA funds to purchase:

a. For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

b. Telecommunications or video surveillance services provided by such entities or using such equipment.

c. Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

Consistent with 2 CFR 200.471, costs incurred for telecommunications and video surveillance services or equipment such as phones, internet, video surveillance, and cloud servers are allowable except for the following circumstances:

a. Obligating or expending EPA funds for covered telecommunications and video surveillance services or equipment or services as described in 2 CFR 200.216 to:

- (1) Procure or obtain, extend or renew a contract to procure or obtain;
- (2) Enter into a contract (or extend or renew a contract) to procure; or
- (3) Obtain the equipment, services, or systems.

Certain prohibited equipment, systems, or services, including equipment, systems, or services produced or provided by entities identified in section 889, are recorded in the System for Award Management exclusion list.

104.19i Continuous Operation

Construction activities must allow for the continuous operation of the Water Quality Laboratory. The Contractor will be responsible for staging construction activities and facilitating the temporary relocation of laboratory equipment and materials as necessary.

Contractor Equal Employment Opportunity Certification

During the performance of this contract, the undersigned agrees as follows:

1. The undersigned will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The undersigned will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The undersigned agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this equal opportunity (federally assisted construction) clause.
2. The undersigned will, in all solicitations or advertisements for employees placed by or on behalf of the undersigned, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.
3. The undersigned will send to each labor union or representative of workers, with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representative of the undersigned's commitment under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
4. The undersigned will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
5. The undersigned will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and relevant orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records and accounts by the administering agency of the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
6. In the event of the undersigned's non-compliance with the equal opportunity (federally assisted construction) clause of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated or suspended in whole or in part, and the undersigned may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rules, regulations, or order of the Secretary of Labor, or as provided by law.
7. The undersigned will include this equal opportunity (federally assisted construction) clause in every subcontract or purchase order unless exempted by the rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order No. 11246 of September 24, 1965, so that such provision will be binding upon each subcontract or vendor. The undersigned will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for non compliance: Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor, as a result of such direction by the administering agency the undersigned may request the United States to enter into such litigation to protect the interest of the United States.

(Signature)

(Date)

(Name and Title of Signer, Please type)

(Firm Name)

Certification Regarding Debarment, Suspension, and Other Responsibility Matters

INSTRUCTIONS

Under Executive Order 12549 an individual or organization debarred or excluded from participation in Federal assistance or benefit programs may not receive any assistance award under a Federal program or a subagreement thereunder for \$25,000 or more.

Accordingly, each prospective recipient of an EPA grant, loan, or cooperative agreement and any contract or subagreement participant thereunder must complete the attached certification provide an explanation why they cannot. For further details, see the regulation 40 CFR 32.510, Participants' responsibilities.

Go to <https://sam.gov/content/exclusions> to search for excluded parties. The record includes information regarding entities debarred, suspended, proposed for debarment, excluded or disqualified under the nonprocurement common rule, or otherwise declared ineligible from receiving Federal contracts, certain subcontracts, and certain Federal assistance and benefits. This information may include names, addresses, DUNS numbers, Social Security Numbers, Employer Identification Numbers or other Taxpayer Identification Numbers, if available and deemed appropriate and permissible to publish by the agency taking the action.

Where To Submit

The prospective EPA grant, loan, or cooperative agreement recipient must return the signed certification or explanation with its application to Ohio EPA.

A prospective prime contractor must submit a complete certification or explanation to the individual or organization awarding the contract.

Each prospective subcontractor must submit a complete certification or explanation to the prime contractor for the project.

Applicants may reproduce these materials as needed and provide them to their prospective prime contractor, who, in turn, may reproduce and provide them to prospective subcontractors.

Additional copies / assistance may be requested from:

Ohio EPA
Division of Environmental and Financial Assistance
P.O. Box 1049
Columbus, Ohio 43216-1049
(614) 644-2798
defamail@epa.ohio.gov

Certification Regarding Debarment, Suspension, and Other Responsibility Matters

The prospective participant certifies to the best of its knowledge and belief that it and its principals:

- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- (b) Have not within a three year period preceding this proposal been convicted of or had a civil judgement rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- (c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (b) of this certification;
- (d) Have not within a three year period preceding this application / proposal had one or more public transactions (Federal, State, or local) terminated for cause or default; and
- (e) Will not utilize a subcontractor or supplier who is unable to certify (a) through (d) above.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award. In addition, under 18 USC Sec. 1001, a false statement may result in a fine of up to \$10,000 or imprisonment for up to 5 years, or both.

Type Name & Title of Authorized Representative

Signature of Authorized Representative

Date

☐ I am unable to certify to the above statements. My explanation is attached.

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form**

An EPA Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE¹ subcontractor² the opportunity to describe work received and/or report any concerns regarding the EPA-funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the EPA DBE Coordinator at any time during the project period of performance.

Subcontractor Name		Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Prime Contractor Name		Issuing/Funding Entity:	

Contract Item Number	Description of Work Received from the Prime Contractor Involving Construction, Services , Equipment or Supplies	Amount Received by Prime Contractor

¹ A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

² Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form**

Please use the space below to report any concerns regarding the above EPA-funded project:

Subcontractor Signature	Print Name
Title	Date

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form**

This form is intended to capture the DBE¹ subcontractor's² description of work to be performed and the price of the work submitted to the prime contractor. An EPA Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractors bid or proposal package.

Subcontractor Name		Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Prime Contractor Name		Issuing/Funding Entity:	

Contract Item Number	Description of Work Submitted to the Prime Contractor Involving Construction, Services , Equipment or Supplies	Price of Work Submitted to the Prime Contractor
DBE Certified By: ☐ ODOT ☐ DAS/EDGE ☐ Other: _____		Meets/ exceeds EPA certification standards? ☐ YES ☐ NO ☐ Unknown

¹ A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

² Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form**

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 I.

Prime Contractor Signature	Print Name
Title	Date

Subcontractor Signature	Print Name
Title	Date

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form**

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE¹ subcontractors² and the estimated dollar amount of each subcontract. An EPA Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Issuing/Funding Entity:			

I have identified potential DBE certified subcontractors	☐ YES ☐ NO		
If yes, please complete the table below. If no, please explain:			
Subcontractor Name/ Company Name	Company Address/ Phone/ Email	Est. Dollar Amt.	Currently DBE Certified?

Continue on back if needed

¹ A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

² Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form**

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 I.

Prime Contractor Signature	Print Name
Title	Date

BUILD AMERICA. BUY AMERICA (BABA) ACKNOWLEDGEMENT

The Contractor acknowledges to and for the benefit of the _____ (“Owner”) and the State of Ohio (State) that it understands the goods and services under this Agreement are being funded with federal monies and have statutory requirements commonly known as “Build America, Buy America;” that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the United States (“Build America, Buy America Requirements”) including iron and steel, manufactured products, and construction materials provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and Funding Authority (a) the Contractor has reviewed and understands the Build America, Buy America Requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the United States in a manner that complies with the Build America, Buy America Requirements, unless a waiver of the requirements is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the Build America, Buy America Requirements, as may be requested by the Owner or the Funding Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner or Funding Authority to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Owner or Funding Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Funding Authority or any damages owed to the Funding Authority by the Owner). If the Contractor has no direct contractual privity with the Funding Authority, as a lender or awardee to the Owner for the funding of its project, the Owner and the Contractor agree that the Funding Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the Funding Authority.

Signature

Date

Name and Title of Authorized Signatory, Please Print or Type

Bidder’s Firm

AMERICAN IRON AND STEEL ACKNOWLEDGEMENT

The Contractor acknowledges to and for the benefit of the City of _____ (“Purchaser”) and the State of Ohio (the “State”) that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as “American Iron and Steel;” that requires all of the iron and steel products used in the project to be produced in the United States (“American Iron and Steel Requirement”) including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Signature

Date

Name and Title of Authorized Signatory, Please Print or Type

Bidder’s Firm

- ☐ Check here if the WPCLF or WSRLA applicant will be requesting an individual waiver for non-American made iron and steel products. Please note that the waiver box does not need to be marked for nationwide waivers.

CONTRACT CHANGE ORDER

RECIPIENT _____ CHANGE ORDER NBR _____
 LOAN NUMBER _____ CONTRACT _____
 OWDA PROJECT No. _____ DATE _____
 Description of Change: _____

The time provided for completion in the contract for the above items is (increased/decreased) by ____ calendar days.

RECOMMENDED BY: _____ DATE: _____
 (Engineer)

APPROVED BY: _____ DATE: _____
 (Recipient)

ACCEPTED BY: _____ DATE: _____
 (Contractor)

 (Company)

Original Contract Amt		OWDA APPROVAL The above proposal is hereby accepted and I recommend that it be approved and made a part of the contract noted above. The approval does not constitute an increase in the total loan amount, but represents approval for the work.
Previous Changes (+ / --)		
This Change (+ / --)		
Adjusted Contract Amt		
Ohio EPA Acceptance		Chief Engineer
Date		Date

CHANGE ORDER INSTRUCTIONS:

All Change Orders for this work, regardless of costs and whether Water Pollution Control Loan Fund (WPCLF) or Water Supply Revolving Loan Account (WSRLA) funding will be used to finance the changes, must be submitted to Ohio EPA for review.

Changes Requiring Prior Approval

Any change which substantially modifies the Project Facilities as specified in the Ohio EPA approved Facilities Plan and Final Permit to Install or Final Plan Approval (when applicable) or alters the direct or indirect impact of the Project Facilities upon the environment must be incorporated into a Change Order. One copy of the Change Order prior to execution is to be submitted to Ohio EPA for review and prior approval of the acceptability of the change. "Prior to execution" means before the Change Order is signed by the Owner.

Ohio EPA will review the Change Order and inform the Owner of the technical, environmental and operational acceptability of the change, and give the Owner permission to proceed with the proposed work.

All Other Changes

Change Orders not requiring prior approval as described above must be submitted to Ohio EPA within one (1) month of the time at which they are approved by the Owner. All change orders must be submitted electronically to dedicated change order email addresses for WPCLF and WSRLA projects.

Change Order Approval Process

After the Change Order is executed, one (1) copy of the Change Order, including the supporting documentation, is to be sent electronically to Ohio EPA for final review.

The dedicated e-mail address for the electronic submittal of WPCLF Change Orders is EPAWPCLFCO@epa.ohio.gov.

The dedicated e-mail address for the electronic submittal of WSRLA Change Orders is EPAWSRLACO@epa.ohio.gov.

After the Change Order is accepted and eligible costs determined, Ohio EPA will issue a letter informing the Owner and authorizing OWDA to disburse funds from Project Contingency for the work. The OEPA letter will be sent electronically along with a PDF of the WPCLF/WSRLA Change Order form which will be signed by all parties including Ohio EPA and OWDA.

Payments for Change Order Work

The Owner is precluded from submitting to the OWDA payment requests for Eligible Project Costs associated with the Change Orders until such time as the Ohio EPA's approval of the Change Orders has been obtained.

**DOCUMENT 00 3132
GEOTECHNICAL DATA**

1.1 GEOTECHNICAL DATA

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.
- B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.
- C. A geotechnical investigation report for Project, prepared by DHDC Engineering Consulting Services, Inc., dated December 3, 2024, is available for viewing as appended to this Document.
 - 1. 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 the data.
 - 2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.

END OF DOCUMENT

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**GEOTECHNICAL INVESTIGATION REPORT
CITY OF DAYTON CENTRAL WATER QUALITY LAB
BUILDING ADDITIONS
3210 CHUCK WAGNER LANE
DAYTON, OHIO 45414
DHDC PROJECT NUMBER: D24-048**

For:

**App Architecture
615 Woodside Drive
Englewood, Ohio 45322**

Submitted by:

**DHDC Engineering Consulting Services, Inc.
2390 Advanced Business Center Drive
Columbus, Ohio 43228**

Date:

December 3, 2024



2390 Advanced Business Center Drive
Columbus, Ohio 43228
o: 614.527.7656
www.dhdcinc.com

December 3, 2024

Fernando Oseguera, AIA
Senior Project Manager
App Architecture
615 Woodside Drive
Englewood, Ohio 45322
O: 937.836.8898, ext. 107

Subject **Geotechnical Investigation Report**
City of Dayton Central Water Quality Lab - Building Additions
3210 Chuck Wagner Lane
Dayton, Ohio 45414
DHDC Project Number: D24-048

Dear Mr. Oseguera:

In compliance with your request, DHDC Engineering Consulting Services, Inc. (DHDC) has completed a subsurface exploration and geotechnical evaluation for the above referenced project. We appreciate the opportunity to be of service to you on this project. If you have any questions regarding our report or if we may be of further service, please contact us at your earliest convenience.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Mohammed O. Haque".



Mohammed O. Haque, P.E.
Geotechnical Engineer

A handwritten signature in black ink, appearing to read "Savvas P. Sophocleous".

Savvas P. Sophocleous
Project Manager

Attachment

GEOTECHNICAL INVESTIGATION REPORT

City of Dayton Central Water Quality Lab - Building Additions

3210 Chuck Wagner Lane

Dayton, Ohio 45414

DHDC Project Number: D24-048

EXECUTIVE SUMMARY

The following information is provided as a brief summary of the data obtained for this study and our geotechnical recommendations that are more fully detailed within this report. The report should be read in its entirety prior to the implementation of these recommendations into project design and construction.

1. Three (3) building additions or structures are proposed to the existing Dayton Central Water Quality Laboratory. It is DHDC's understanding that the proposed building additions will be single story, slab-on-grade tall structures. It is DHDC's understanding that the proposed building additions will be supported by load bearing masonry walls and interior and exterior columns. In addition to the building addition structures, new sidewalks will be constructed in some areas of the proposed building additions.
2. Seven (7) soil borings were performed for this investigation. Based on a site plan showing the proposed boring locations, DHDC staked the borings in the field. The soil boring locations shown on the Boring Location Plan should be considered approximate.
3. Possible fill and man-made fill material was encountered in all seven (7) borings drilled for this investigation. The bottom of these materials ranged from about 3.0 to 5.5 feet below the exposed grade. These possible fill and man-made fill materials were mostly free of any foreign and deleterious materials.

The naturally occurring native cohesive soil encountered at this site consisted of sandy clay with little to some amounts of gravel. The cohesive soils are low to moderate plasticity CL soil according to the Unified Soil Classification System (USCS).

Below the possible fill or man-made fill or naturally occurring cohesive soils, cohesionless soil consisting of silty sand and gravel was encountered in all seven (7) soil borings to depths ranging from 22.0 to the maximum depth explored of 25.0 feet below the boring surface grades. Due to the presence of coarse gravel and cobble and possible boulder, very high N-values were encountered.

Below the cohesionless soil in Borings B-3, B-4, and B-6, cohesive silty sandy clay glacial till soil was encountered to the maximum depth explored of 25.0 feet below the boring surface grades. The silty sandy clay soil is low to moderate plasticity CL soil according to the USCS.

4. No groundwater was encountered at any of the seven (7) borings during, at completion of the drilling operations, or after few hours of drilling operations.

5. Based on the soil borings information DHDC couldn't make accurate prediction about the aerial extent and the actual depth of fill materials. Hence, DHDC recommends inspection of few test-pits prior to earthwork within the proposed construction site to determine the aerial extent and the actual depth of fill materials.
6. DHDC recommends that all existing fill materials, as well as any unstable naturally occurring soils under the proposed building addition structures should be undercut and replaced with compacted engineered fill. Provided that the exposed grade at a depth of 1.5 feet below the finished subgrade elevation within the proposed new sidewalks is free of any organics and the excavated exposed surface passes the proofroll test, then the remaining existing fill material can stay in place. Failed proofrolled subgrade areas will require stabilization or undercutting.
7. Once the undercutting has been done and the site is prepared and engineered fill placed and compacted, conventional shallow spread footing may be used to support the proposed structures. DHDC recommended that the shallow foundations units may be proportioned using a net allowable soil bearing capacity value of 3,500 pounds per square foot (psf) for both column (square) and wall (strip) footings.

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation and soils evaluation for the proposed building and structure additions to the existing Dayton Central Water Quality Laboratory building structure located at 3210 Chuck Wagner Road in Dayton, Montgomery County, Ohio. The purpose of this investigation was to determine the general types of subsoils present at the proposed site, to make an evaluation of their likely impact on the proposed development and to make comments and recommendations relative to the design and construction of earthwork and building addition foundations for this project. Also, selected pertinent comments and recommendations regarding earthwork and foundation construction are provided.

The scope of this investigation included a review of available geologic and soils data for the project area, a subsurface investigation consisting of seven (7) standard soil test borings located as shown on the attached Boring Location Plan in the Appendix, field and laboratory soil testing, and an engineering analysis and evaluation of the subsurface conditions encountered at this site.

2.0 PROJECT AND SITE CHARACTERISTICS

Three (3) building additions or structures are proposed to the existing Dayton Central Water Quality Laboratory. It is DHDC's understanding that the proposed building additions will be single story, slab-on-grade tall structures. In addition to the building addition structures, new sidewalks will be in some areas of the proposed building additions.

DHDC has assumed that the proposed building additions or structures will be supported by load bearing masonry walls, and interior and exterior columns. In addition, there will also be some interior non-load bearing masonry walls, which will rest directly on the floor slab. DHDC has not been made aware of any special or unusual loading conditions or settlement restrictions for the proposed building additions, nor have column and wall loads for the proposed structures been provided. DHDC has assumed the following loads for the proposed building addition structures.

- Maximum wall load – 5.0 kips per linear foot (klf).
- Maximum column load – 100 kips.

Currently the site of the proposed building addition areas is open grassy lawn. The existing grade just around the existing building is few feet in higher elevation than the surrounding grades. Hence, some of the borings were drilled through the relatively higher elevation areas and some through the lower elevation areas. The elevation difference between the higher and the lower elevations can range from about 3.0 to 4.0± feet. It is DHDC's understanding that the finished floor elevation of the proposed building additions will match the finished floor elevation of the existing building. Hence, approximately 3.0 to 4.0 feet of new fill needs to be placed within the lower elevation areas to bring the existing grade to the proposed finished floor subgrade elevation.

DHDC's site reconnaissance indicates no surface features that would indicate unusual subsurface problems. The ground was relatively dry and firm under foot at the time of DHDC's field investigations.

3.0 INVESTIGATIVE PROCEDURES

Seven (7) soil borings were performed for this investigation. Based on a site plan showing the proposed boring locations, DHDC staked the borings in the field. The boring locations shown on the Boring Location Plan should be considered approximate. DHDC recommends surveying of the drilled boring locations. DHDC also recommends that the surveyed boring locations should be shown on the finalized site plan. Soil borings and the proposed building additions/structures are shown below.

- Lab Addition – Borings B-1, B-2, and B-7
- Admin Addition – Borings B-3, B-4, and B-5
- New Barrel Storage Shed – Boring B-6
- New Sidewalk – Boring B-3 falls within the proposed sidewalk located just south of the proposed Admin Building addition.

The test borings were performed in accordance with geotechnical investigative procedures outlined in American Society for Testing and Materials (ASTM) Standards D 1452 and D 5434. The test borings were performed utilizing 2¼-inch inside diameter hollow-stem augers. Soil samples were collected at 2.5-foot intervals to a depth of 10.0 feet below the boring surface grades and then 5.0 feet thereafter to the maximum depth explored.

Split-spoon samples were obtained by the Standard Penetration Test (SPT) Method (ASTM D 1586), which consists of driving a 2.5-inch outside diameter split-spoon sampler into the soil with a 140-pound weight falling freely through a distance of 30 inches. The sampler was driven in three successive 6-inch increments with the number of blows per increment being recorded. The sum of the number of blows required to advance the sampler the second and third 6-inch increments is termed the Standard Penetration Resistance (N-value) and is presented on the Logs of Test Borings attached to this report. The split-spoon samples were sealed in jars and transported to our laboratory for further classification and testing.

Soil conditions encountered in the test borings are presented in the Logs of Test Borings, along with information related to sample data, SPT results, water conditions observed in the borings, and laboratory test data. It should be noted that these logs have been prepared on the basis of laboratory classification and testing as well as on field logs of the encountered soils. All samples of the subsoils were visually or manually classified using the Unified Group Soil Classification System (ASTM D-2487 and D-2488). All soil samples were tested in the laboratory for moisture content. Atterberg Limits test and grain size analysis were performed on selected soil samples. Pocket Penetrometer test, which is the approximate Unconfined Compressive Strength was performed on intact cohesive soil samples. The results of these tests are presented on the soil boring logs attached to this report.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 Site Geologic Conditions

The project site is located within the east central portion of Montgomery County, Ohio. The “Soil Survey of Greene County, Ohio”, published by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS), was reviewed for general near-surface soil information within the general vicinity of the subject project. This information indicates that there are few mapping units, i.e., Xenia silt loam, Wynn silt loam, Russell-Miamian silt loams, and Dana silt loam within the proposed project area. Some of these soils are moderately well and some are poorly drained soils.

These soils were formed partly in loess and partly in the underlying glacial till of Wisconsinan age glaciation. The till materials consist of interbedded layers of silt, silty clay, silty sandy clay, and sandy silt. The glacial soils are typically brown and gray to gray silty to silty sandy clay. Glacial tills in this portion of Ohio are typically low to moderate plasticity soils. Interbedded thin to thick layers of sand and gravel are usually encountered within the cohesive glacial till soil. These interbedded thick layers of cohesionless soils are glacial outwash. Coarse gravel and cobble, and occasional boulder are encountered within the glacial till and glacial outwash soil matrix. The underlying bedrock material consists of interbedded plastic shale and limestone layers.

4.2 Soil Profile

Topsoil

The borings were drilled through the grassy areas. Topsoil was encountered as surface material. Thickness of topsoil encountered in the borings ranged from about 6.0 to 9.0 inches. This material is dark clayey silt containing considerable organic matter because of the past vegetation. Topsoil is generally unsuitable for structural support and should be wasted or stockpiled for later landscaping use.

Man-Made Fill and possible Fill Materials

Possible fill and/or man-made fill material was encountered in all Seven (7) borings drilled for this investigation. Possible fill is defined as the material which can either be man-made fill or naturally occurring native soil.

The bottom of the possible fill and/or man-made fill material at the boring locations ranged from about 3.0 to 5.5 feet below the exposed grade. The possible fill materials consisted of silty clay and sandy clay. Trace amounts of hair roots or coarse gravel were encountered within some of the possible fill materials. The Standard Penetration Test N-values within the possible fill materials ranged from 8 to 17 blows per foot (bpf) and the moisture content ranged from 13 to 18 percent.

The man-made fill materials consisted of both cohesive and cohesionless soils. The cohesive fill materials consisted of sandy clay and silty clay. The cohesionless soil consisted of clayey sand. Rock fragments were encountered within some of the fill materials. The N-values within the cohesive fill materials ranged from 6 to 17 bpf and the moisture content ranged from 10 to 21 percent. The N-values within the cohesionless fill material was 12 bpf and the moisture content was 12 percent. The following table shows the bottom of the fill materials and/or possible fill materials encountered at the boring locations.

TABLE –I	
Boring No.	Bottom of Fill and/or Possible Material (ft.)
B-1	3.0 ₊
B-2	5.5 ₊
B-3	3.0 ₊
B-4	3.0 ₊
B-5	3.0 ₊
B-6	3.0 ₊
B-7	5.5 ₊

Naturally Occurring Native Overburden Soils

As stated earlier, the possible fill materials consisted of sandy clay soil, which can be either man-made fill or naturally occurring soil. Naturally occurring native cohesive sandy clay soil was encountered only in Boring B-3 below the fill material and continued to a depth of about 7.0 feet below the boring surface grade. The N-values within the sandy clay soil was 12 bpf, indicating stiff soil consistency. The moisture content of the sandy clay soil was 22 percent. Pocket Penetrometer value on intact soil sample was 3.0 tons per square foot (tsf). The cohesive sandy clay soil is low to moderate plasticity CL soil according to the Unified Soil Classification System (USCS).

Below the man-made fill or possible fill material or naturally occurring cohesive soils, cohesionless soil consisting of silty sand and gravel was encountered in all seven (7) soil borings to depths ranging from 22.0 to the maximum depth explored of 25.0 feet below the boring surface grades. Coarse gravel and cobble were encountered within the cohesionless soil matrix. Occasionally interbedded sandy clay layers were observed within the cohesionless soil matrix at various elevations. The N-values ranged from 15 to more than 50 bpf but were mostly over 30 bpf. The high N-values are due to the presence of coarse gravel and cobble within the soil matrix.

The following table shows the bottom of cohesionless silty sand and gravel in the borings.

Table - II	
Boring No.	Bottom of Cohesionless Soil (ft.)
B-1	25.0*
B-2	25.0*
B-3	22.5
B-4	22.0
B-5	25.0*
B-6	22.0
B-7	25.0*

* Maximum depth explored.

Below the cohesionless soil in Borings B-3, B-4, and B-6, cohesive silty sandy clay glacial till soil was encountered to the maximum depth explored of 25.0 feet below the boring surface grades. The N-values ranged from 45 to more than 50 bpf and the moisture content ranged from 8 to 9 percent. Pocket Penetrometer values on the intact soil samples were more than 4.5 tons per square foot (tsf). The silty sandy clay soil is low to moderate plasticity CL soil according to the USCS.

Bedrock

No bedrock was encountered at any of the seven (7) borings drilled for this investigation to the maximum depth explored of 25.0 feet below the boring surface grades.

4.3 Groundwater Conditions

Groundwater observations were made during the drilling operations (by noting the depth of water on the drilling tools), immediately after the removal of the augers in open hole, and also few hours after the drilling operations. No groundwater was encountered at any of the seven (7) borings during, at completion of the drilling operations, or after few hours of drilling operations. Although the groundwater observation did not produce any specific information regarding the true groundwater table, it is possible that some perched or trapped groundwater can be encountered within the cohesionless soil at the interface of less permeable interbedded sandy clay soil.

4.4 Seismic Site Classification

The Ohio Building Code (OBC) follows International Building Code (IBC) with regards to seismic guidelines. As part of the OBC code, the seismic properties of the overburden soils and bedrock are utilized to determine the site seismic classification. The Seismic Site Class is determined by evaluation of the shear wave velocities of the overburden soil and bedrock to a depth of 100 feet.

Based on the boring findings, review of geological information, and in accordance with the Ohio Building Code – Site Class Definitions, DHDC recommends the site as a Site Class D – stiff/dense soil profile.

5.0 GEOTECHNICAL CONCLUSIONS & RECOMMENDATIONS

Based upon our analysis of the soil conditions and the preliminary design details supplied for this project by the client as previously outlined, the following recommendations were developed. If the project characteristics are changed from those assumed herein, or if different subsurface conditions are encountered during construction, DHDC should be notified, so that our recommendations can be reviewed to see whether any modifications are needed.

5.1 Important Information and Findings

- Possible fill and man-made fill material was encountered in all seven (7) borings drilled for this investigation. The bottom of the possible fill and man-made fill materials ranged from about 3.0 to 5.5 feet below the exposed grade. Other than trace amounts of organics and rock fragments, these possible fill and man-made fill materials were free of any foreign and deleterious materials. Physical structure of some of the subsurface soils encountered in the borings is very baffling, indicating that these soils can be either man-made fill material or naturally occurring native soil
- Based on the soil borings information DHDC couldn't make accurate prediction about the aerial extent and the actual depth of fill materials. Hence, DHDC recommends inspection of few test-pits prior to earthwork within the proposed construction site to determine the aerial extent and the actual depth of fill materials.
- The naturally occurring native cohesive sandy clay soil encountered in Boring B-3 is stiff in consistency. Based on the N-values, the naturally occurring native cohesionless silty sand and gravel are mostly dense in relatively density. Coarse gravel and cobble were encountered within the cohesionless soil matrix.
- No groundwater was encountered in any of the seven (7) borings drilled for this investigation.

5.2 Building Foundation Recommendations

It is DHDC's understanding that the finished floor elevation of the proposed building additions will match the finished floor elevation of the existing building. Hence, approximately 3.0 to 4.0 feet of new fill needs to be placed within the lower elevation areas to bring the existing grade to the proposed finished floor subgrade elevation.

Inspection of test-pits and review of old and the current topographic plans (if any) will reveal the previous site grading activities. DHDC recommends complete removal of all existing fill material from the footprint of the proposed building structure footprint area and to a distance of at least 10.0 feet beyond the exterior building line and backfilling the undercut areas with compacted engineered fill. Based on the soil borings information it appears that the bottom of excavation will vary from about 3.0 to 5.5 feet below the exposed surface. However, the actual depth of undercut will be determined during the earth excavation. Provided that all existing fill materials are removed as recommended above and the undercut areas backfilled with compacted engineered fill, the footing will rest on compacted engineered fill supported by satisfactorily proofrolled naturally occurring native soil.

Once the foundation areas are prepared as recommended above, conventional shallow spread footing may be used to support the proposed building additions. Continuous (wall) footings, isolated (column) footings, or a combination of both may be utilized to transmit the structural loading to the bearing strata. DHDC recommends that the building addition footings be designed for a maximum net allowable bearing pressure of 3,500 pounds per square foot (psf) for both column (square) and wall (strip) footings.

This recommended soil bearing value should be considered the upper limit, and any value less than that listed above would be acceptable for the foundation system. It is strongly recommended that careful observation of the undercut excavation as well as all foundation excavations be carried out by a representative of DHDC to identify existing fill and other unsuitable materials and to recommend appropriate remedial actions as necessary.

In using net pressure, the weight of the footing and backfill over the footing, including the weight of the floor slab need not be considered; hence, only loads applied at or above the finished floor need to be used for dimensioning the footings. Furthermore, wall footings and isolated column footings should be at least 18 inches wide and 24 inches square, respectively (or as per applicable building code requirements, whichever is larger) for protection against a punching shear type of failure.

Provided that the footings are designed as prescribed herein and inspected, it is estimated that the post construction total and differential foundation settlements will not exceed approximately 1 inch and $\frac{3}{4}$ inches, respectively. Careful field control will contribute substantially to minimizing the settlements.

Uplift forces on footings due to wind load can be resisted by the weight of the footings and the soil material that is placed over the footings. It is recommended that the soil weight be limited to that immediately above and within the perimeter of the footings (unless a much higher factor of safety is used). A total soil unit weight of 115 pounds/cubic foot can be used for the backfill material adjacent to and

above the footings, provided it is compacted as recommended. It is also recommended that a factor of safety of at least 1.2 be used for calculating uplift resistance from the footings (provided only the weight of the footing and the soil immediately above it are used to resist uplift forces).

Lateral forces on a shallow spread footing can be resisted by the passive lateral earth pressure against the side of the footing and by friction between the subgrade soil and the base of the footing. A uniform allowable passive pressure of 500 pounds/square foot can be used for that portion of the footing that is below a depth of 3.0 feet below the final exterior grade (no portion of the footing above this depth should be used for lateral resistance). An allowable coefficient of friction (between the base of the footing and the underlying soil) of 0.20 can be used in conjunction with the minimum downward load on the base of the footing.

The footings should be taken to at least 3.0 feet below the final exterior grade for frost protection. All foundation bearing surfaces should be protected against freezing, surface water and undue disturbance as the cohesive soils will tend to soften and increase settlements in such cases. If possible, the footing concrete should be placed the same day that the excavation takes place. If this is not feasible, proper protection of the footing excavations should be provided. All footing excavations should be observed by a representative of DHDC to assure that adequate bearing is achieved before placing concrete for the foundations.

5.3 Floor Slab

Undercutting of existing fill materials and backfilling the undercut areas have been discussed in Sections 5.1 and 5.2 of this report. Since the site will be prepared as per the recommendations of Sections 5.1 and 5.2 of this report, the floor slab will rest on compacted engineered fill. DHDC recommends that the floor slab subgrade areas be proofrolled prior to the placement of the granular subbase material.

Particular attention should be paid to the placement of backfill against the foundation and beneath the slab as inadequate compaction at these locations may cause cracking of the slab edges and corners due to subsidence of the backfill. The slab should be “free floating”, i.e., not structurally attached to adjacent walls or foundations.

It is DHDC’s recommendation that the floor slabs be supported on a minimum six (6) inch thickness of clean, compacted granular material (ODOT Item No. 304 stone), to help distribute concentrated loads and to allow equalization of moisture conditions beneath the slab. Provided that the above granular cushion is in place, a modulus of subgrade reaction (k_{30}) of 110 pounds per sq. inch per inch can be used for design of the floor slabs.

A vapor barrier may not be required beneath the floor slabs unless the floors are covered with moisture sensitive flooring. It should be noted that vapor barrier can have adverse effects on concrete curing and performance. If used, the vapor barrier should be installed in accordance with the recommendations contained in the ACI Manual of Concrete Practice 302.1 R, Guide for Concrete Floor and Slab Construction,

and should be placed below the crushed stone layer. If the vapor barrier is placed immediately below the concrete slab, a coefficient of friction between the slab-on-grade concrete floor and the vapor barrier of 0.15 should be used.

5.4 New Sidewalks

The borings revealed 3.0 to 5.5 feet of fill at this site. DHDC recommends removal of at least 1.5 feet of existing fill material below the finished subgrade elevation. Provided that the exposed subgrade after the excavation is free of any organics and the exposed surface passes the proofroll test, then the remaining existing fill material can stay in place. Failed proofrolled subgrade areas will require stabilization or undercutting.

Minimizing the infiltration of water into the subgrade and rapid removal of any subsurface water will be essential in assuring successful long-term performance of pavements. Both the subgrade and the pavement surface should have a minimum slope of one-quarter (1/4) inch per foot to promote drainage. A means of water outlet should be provided at the pavement edges by extending the aggregate base course through to daylight or to surface drainage features such as storm inlets.

5.5 Subgrade Preparation and Fill Construction

Subgrade Preparation

Site specific subgrade preparation, fill materials and unsuitable subgrade soil removal recommendations have been provided in Sections 5.1, 5.2, and 5.4. After the undercut, the exposed subgrade should be proof rolled with suitable heavy equipment, preferably a 20- to 30-ton loaded dump truck. Any soft or loose yielding areas delineated by proof rolling operations should be undercut or otherwise stabilized as directed by the geotechnical engineer prior to placing structural fill. The clayey cohesive soils will tend to “pump and rut” under construction traffic if they become wet. They will also become difficult to properly compact if the water content of the soil is significantly greater than the optimum moisture content. Depending upon the field moisture conditions at the time of construction, it may be necessary to undercut or otherwise stabilize these soils. The client should be prepared to deal with these conditions at the time of construction.

Recommended Fill Materials

The existing fill materials were free of abundance of organics and deleterious materials. If at the time of construction, the excavated existing fill materials appear to be free of organics and deleterious materials, the existing fill materials can be reused as compacted engineered fill. It is recommended that the on-site geotechnical engineer or technician inspect the existing excavated fill materials prior to their use as compacted engineered fill.

The engineered fill material should consist of naturally occurring native well graded cohesionless soil or low to moderate plasticity cohesive soil having the USCS soil classification of GW, GM, SW, GC, SC, CL, or a combination of these groups. The on-site naturally occurring native cohesive and cohesionless soils can be used as compacted engineered fill.

In general, the proposed fill should have a plasticity index value no higher than 25, a liquid limit no more than 50, maximum dry density of at least 100 pounds per cubic foot, and organic content less than 5 percent. The fill should contain no pieces whose greatest dimension is larger than the thickness of the lift being placed (no more than 3 inches in dimension). If fill construction takes place during the winter months, care should be taken so as not to place fill over frozen soil nor should froze materials be used within the fill. The unsuitable fill soils consist of the following:

- High Plasticity Soil, CH
- Organic soils, OL and OH
- SILT and Sandy Silt, ML, MH, SM
- Uniform or Gap Graded Granular Soil, SP or GP
- Exposed rock, shale, and coal

The fill should be placed in lifts of uniform thickness. The lift thickness should not exceed that which can be properly compacted throughout its entire depth with the equipment available. DHDC recommends that the structural fills supporting footings, floor slabs, and pavements be compacted to at least 100 percent of the maximum Standard Proctor dry density (ASTM D-698) or 95 percent of the maximum Modified Proctor dry density (ASTM D-11567). For proper and timely construction of the fills, the soils should be placed at or near the optimum moisture content as determined by the specified Proctor test. Suitable equipment for either aerating or adding water should be available as the soil moisture and weather conditions dictate.

5.6 *Excavation*

Excavation will be required to remove the existing fill material along the existing building exterior foundation wall. It is DHDC's recommendation that each segment of excavation along the existing building exterior wall foundation be no more than 10 feet. After the excavation, the excavated areas be backfilled with compacted engineered fill and then another segment can be opened.

All temporary excavations for the installation of foundations, utilities, etc., should be properly laid back or braced in accordance with Occupational Safety and Health Administration (OSHA) and any other applicable requirements. Any nearby existing facilities, such as sidewalks, streets, utilities, etc., should be suitably protected from undermining due to excavation for the new structure. All federal, state and local safety regulations should be followed in this regard.

All temporary excavations for the installation of the foundation and underground utility lines should be properly laid back or braced in accordance with Occupational Safety and Health Administration (OSHA) requirements. The cohesive naturally occurring soils encountered in the borings can be classified as OSHA

Type “B”. As per OSHA Soil Classification system, granular soil including gravel, and/or stone fragments, submerged soil, or soil from which water is freely seeping, and submerged rock that is not stable are classified as Type C soils.

OSHA Type “B” soils require side slopes for maximum excavation depths of no more than 12 feet to be no steeper than 1.0H:1.0V ($\phi = 45^\circ$). OSHA Type “C” soils require side slopes for excavations deeper than 5 feet to be no steeper than 1.5H:1.0V ($\phi = 34^\circ$) and the maximum height of the excavation no more than 20 feet, or that they be properly braced during construction for safety purposes.

6.0 QUALIFICATION OF RECOMMENDATIONS

Our evaluation has been based on our understanding of the site and project information and the data obtained during our field investigation. The general subsurface conditions were based on interpretation of the subsurface data at specific boring locations. Regardless of the thoroughness of a subsurface investigation, there is the possibility that conditions will differ from those encountered at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, experienced geotechnical engineers should observe construction to confirm that the conditions anticipated in design are noted. Otherwise, DHDC assumes no responsibility for construction compliance with the design concepts, specifications, or recommendations.

The design recommendations in this report have been developed on the basis of the previously described project characteristics and subsurface conditions. If project criteria or locations change, DHDC should be permitted to determine whether the recommendations must be modified. The findings of such a review will be presented in a supplemental report.

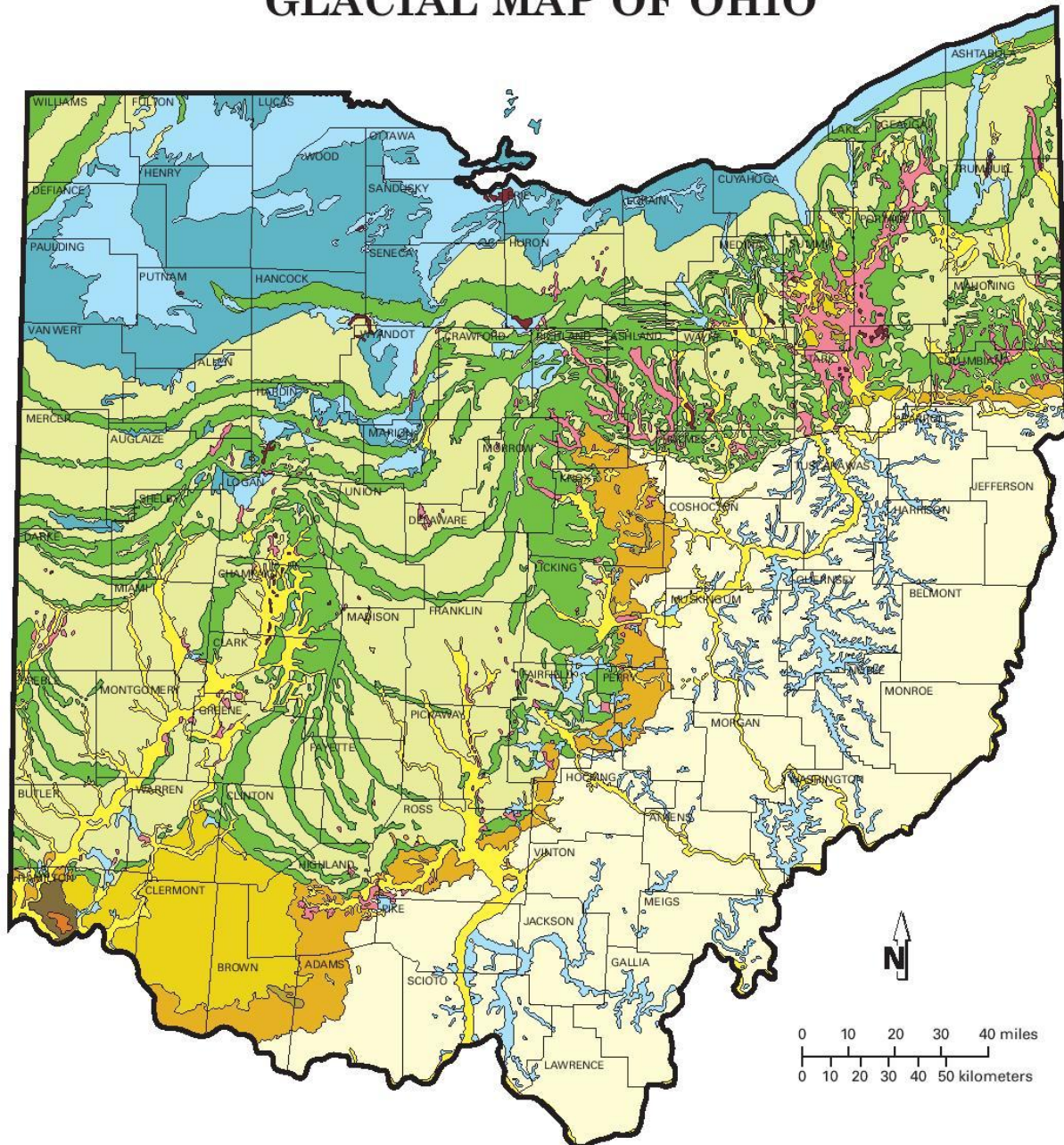
Our professional services have been performed, our findings derived, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied. DHDC is not responsible for the conclusions, opinions, or recommendations of others based on this data.



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APPENDIX: GEOLOGICAL MAPS

GLACIAL MAP OF OHIO



WISCONSINAN
(14,000 to 24,000 years old)

- Ground moraine
- Wave-planed ground moraine
- Ridge moraine

ILLINOIAN
(130,000 to 300,000 years old)

- Ground moraine
- Dissected ground moraine
- Hummocky moraine

PRE-ILLINOIAN
(older than 300,000 years)

- Ground moraine
- Dissected ground moraine

- Kames and eskers
- Outwash
- Lake deposits
- Peat
- Colluvium



Recommended citation: Ohio Division of Geological Survey, 2005, Glacial map of Ohio: Ohio Department of Natural Resources, Division of Geological Survey, page-size map with text, 2 p., scale 1:2,000,000.



[illegible]

Recommended citation: Ohio Division of Geological Survey, 2006, Bedrock geologic map of Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map BG-1, generalized page-size version with text, 2 p., scale 1:2,000,000. [Revised 2017.]



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APPENDIX: SITE VICINITY MAP

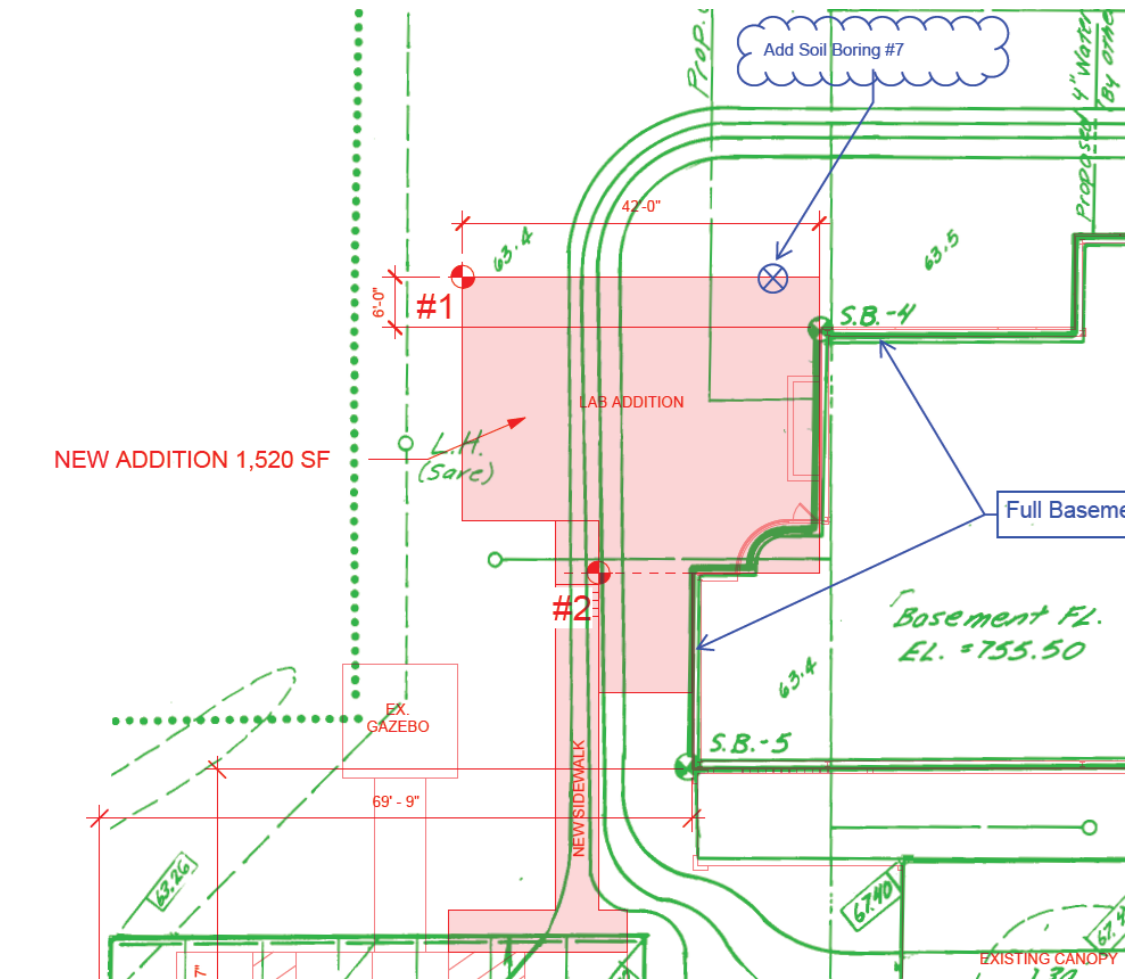


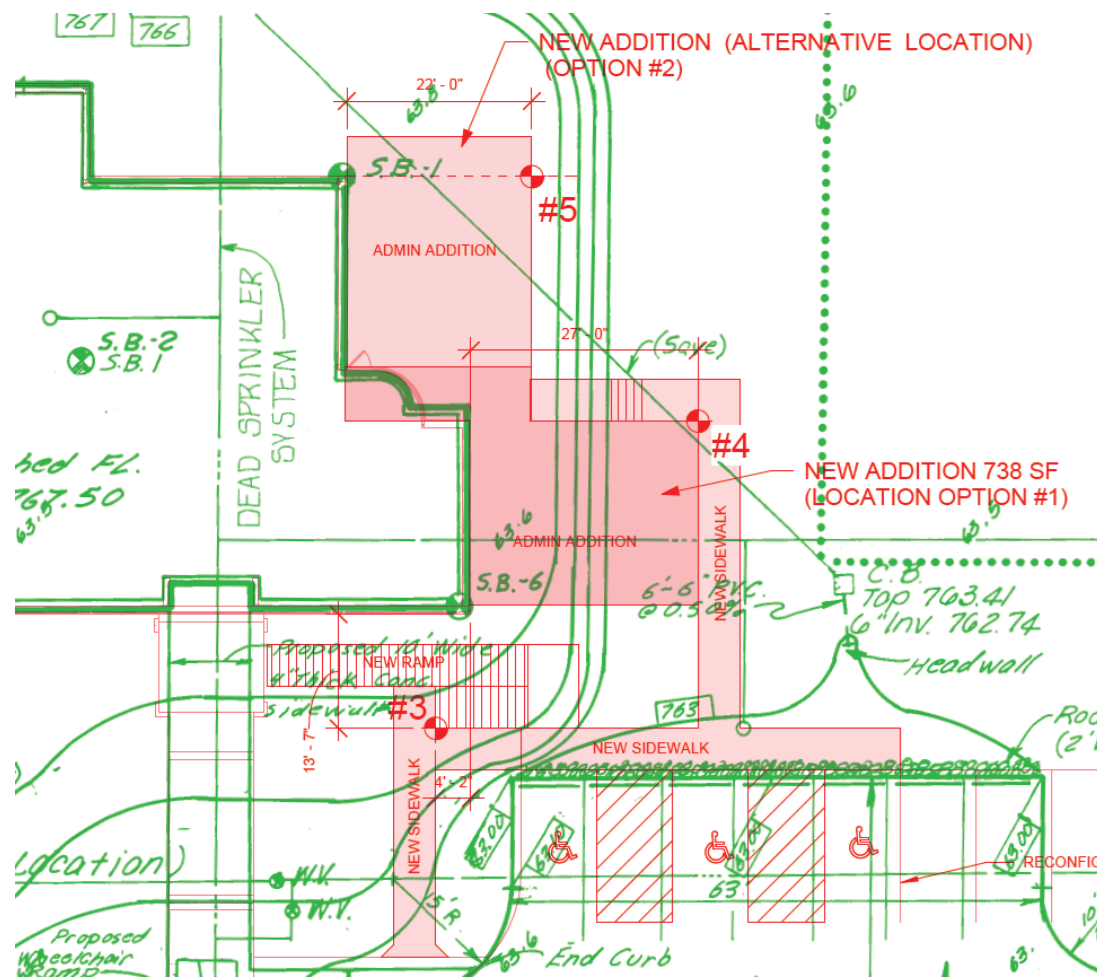
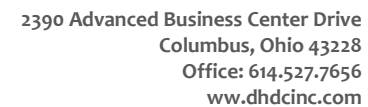
SITE VICINITY MAP

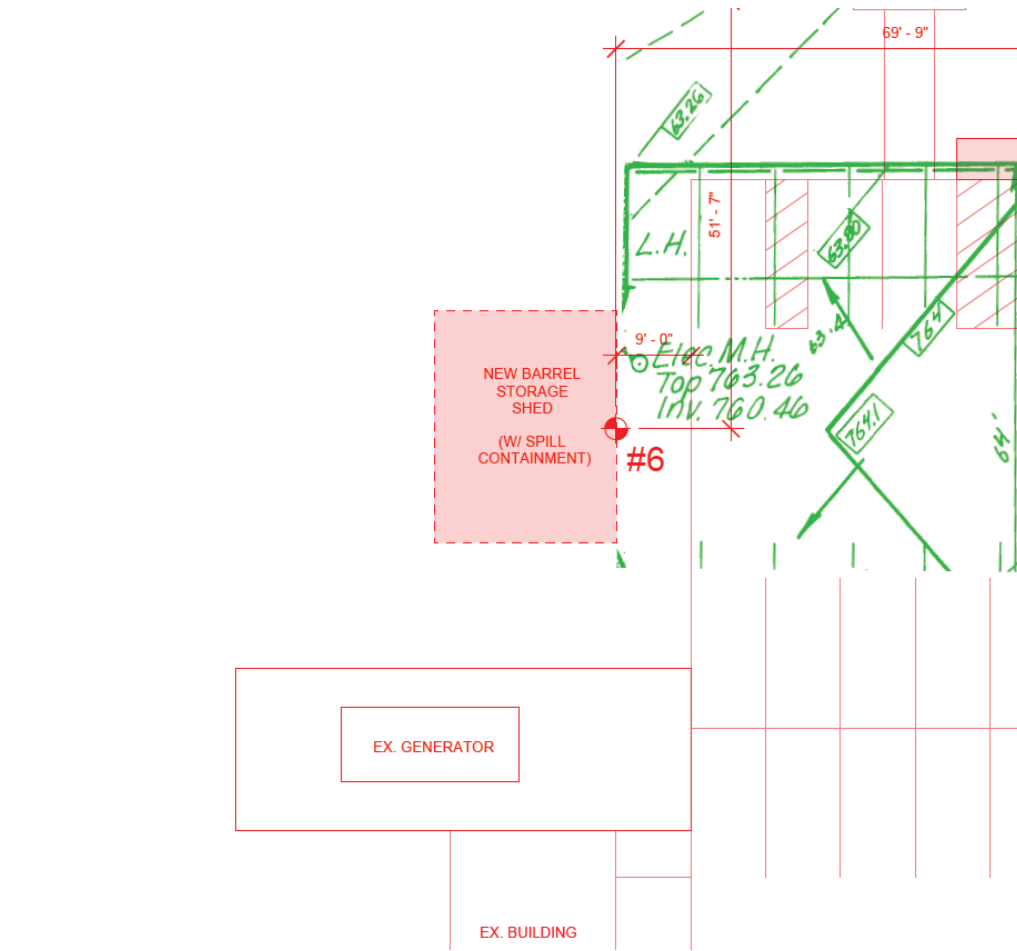


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APPENDIX: BORING LOCATION PLAN









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APPENDIX: SOIL TERMS

DESCRIPTION OF SOIL TERMS

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

GRANULAR SOILS – The relative compactness of granular soils is described as:

<u>Description</u>	<u>Blows per foot – SPT (N)</u>		
Very Loose	2	–	5
Loose	6	–	10
Medium Dense	11	–	30
Dense	31	–	50
Very Dense	Over	–	50

COHESIVE SOILS – The relative consistency of cohesive soils is described as:

<u>Description</u>	<u>Blows per foot – SPT (N)</u>			<u>Unconfined UCS (ksf)</u>		
Very Soft	Below	–	2	Less Than	–	0.50
Soft	2	–	4	0.50	–	1.00
Medium Stiff	5	–	8	1.00	–	2.00
Stiff	8	–	15	2.00	–	4.00
Very Stiff	16	–	30	4.00	–	8.00
Hard	Over	–	31	Over	–	8.00

GRADATION – The following size related denominations are used to describe soils:

<u>Soil Fraction</u>	<u>USCS Size</u>	<u>ODOT Size</u>
Boulders	Larger than 12"	Larger than 12"
Cobbles	12" to 3"	12" to 3"
Gravel – Coarse	3" to 3/4"	3" to 3/4"
Gravel – Fine	3/4" to 4.75 mm	3/4" to 2.0 mm (#10)
Sand – Coarse	4.75 mm to 2.0 mm	2.0 mm to 0.42 mm (#40)
Sand – Medium	2.0 mm to 0.42 mm	
Sand – Fine	0.42 mm to 0.074 mm	0.42 mm to 0.074 mm (#200)
Silt	0.074 mm to 0.005 mm	0.074 mm to 0.005 mm
Clay	< 0.005 mm	< 0.005 mm

MODIFIERS OF COMPONENTS – Modifiers of components are as follows:

<u>Term</u>	<u>Range</u>		
Trace	0%	–	10%
Little	10%	–	20%
Some	20%	–	35%
And	35%	–	50%



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APPENDIX: BORING LOGS

CLIENT APP Architecture

PROJECT NAME Dayton Central Water Quality Lab

PROJECT NUMBER D24-048

PROJECT LOCATION Dayton, OH

DATE STARTED 11/12/24

COMPLETED 11/12/24

GROUND ELEVATION

HOLE SIZE inches

DRILLING CONTRACTOR DHDC

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger

AT TIME OF DRILLING ---

LOGGED BY Daniel

CHECKED BY M.O.H

AT END OF DRILLING ---

NOTES

AFTER DRILLING ---

[illegible]

(Continued Next Page)



BORING NUMBER B-1

PAGE 2 OF 2

CLIENT APP Architecture PROJECT NAME Dayton Central Water Quality Lab
PROJECT NUMBER D24-048 PROJECT LOCATION Dayton, OH

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
20													
		Dense, Brown and Gray, fine to coarse SILTY SAND (SM), and GRAVEL , Moist. ---Coarse GRAVEL and/or COBBLE within the soil matrix--- ---High N-value due to the presence of coarse GRAVEL and/or COBBLE within the soil matrix--- (<i>continued</i>)											
25				SS 7	6	32-35-40 (75)							

Boring discontinued at 25.0 feet depth
No groundwater
Boring caved at 9.0 feet

CLIENT <u>APP Architecture</u>	PROJECT NAME <u>Dayton Central Water Quality Lab</u>
PROJECT NUMBER <u>D24-048</u>	PROJECT LOCATION <u>Dayton, OH</u>
DATE STARTED <u>11/12/24</u> COMPLETED <u>11/12/24</u>	GROUND ELEVATION _____ HOLE SIZE <u>inches</u>
DRILLING CONTRACTOR <u>DHDC</u>	GROUND WATER LEVELS:
DRILLING METHOD <u>Hollow Stem Auger</u>	AT TIME OF DRILLING <u>---</u>
LOGGED BY <u>Daniel</u> CHECKED BY <u>M.O.H</u>	AT END OF DRILLING <u>---</u>
NOTES _____	AFTER DRILLING <u>---</u>

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		TOPSOIL (7") FILL: Dark Brown, SANDY CLAY , little gravel, Moist. ---Rock fragments in sample---		SS 1	89	6-8-6 (14)	4.0		13				
5		POSSIBLE FILL: Dark Brown, SANDY CLAY , little gravel, Moist. ---Coarse GRAVEL within the soil matrix---		SS 2	56	4-7-10 (17)	4.5+		13				
		Medium Dense, Brown and Gray, fine to coarse SILTY SAND (SM) , some gravel, Moist.		SS 3	28	5-7-8 (15)			1				
10		Dense, Brown and Gray, fine to coarse SILTY SAND (SM) , and GRAVEL , Moist. ---Coarse GRAVEL and/or COBBLE within the soil matrix--- ---High N-value due to the presence of coarse GRAVEL and/or COBBLE within the soil matrix---		SS 4	44	13-15-30 (45)			3				
15				SS 5	73	33-50/5"			3				
20				SS 6	56	17-20-20 (40)			4				

(Continued Next Page)

CLIENT APP Architecture PROJECT NAME Dayton Central Water Quality Lab
 PROJECT NUMBER D24-048 PROJECT LOCATION Dayton, OH

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
20													
		Dense, Brown and Gray, fine to coarse SILTY SAND (SM), and GRAVEL , Moist. ---Coarse GRAVEL and/or COBBLE within the soil matrix--- ---High N-value due to the presence of coarse GRAVEL and/or COBBLE within the soil matrix--- (<i>continued</i>)											
25				SS 7	100	20-22-32 (54)			8				

Boring discontinued at 25.0 feet depth
 No groundwater
 Boring caved at 17.0 feet



BORING NUMBER B-3

PAGE 1 OF 2

CLIENT APP Architecture	PROJECT NAME Dayton Central Water Quality Lab
PROJECT NUMBER D24-048	PROJECT LOCATION Dayton, OH
DATE STARTED 11/14/24 COMPLETED 11/14/24	GROUND ELEVATION _____ HOLE SIZE inches
DRILLING CONTRACTOR DHDC	GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger	AT TIME OF DRILLING ---
LOGGED BY Daniel CHECKED BY M.O.H	AT END OF DRILLING ---
NOTES _____	AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		TOPSOIL (9")											
		FILL: Dark Brown, SANDY CLAY , little gravel, Moist. ---Trace hair roots---		SS 1	67	3-4-6 (10)			11				
5		Stiff, Reddish Brown, SANDY CLAY (CL) , little gravel, Moist.		SS 2	72	4-5-7 (12)	3.0		22				
		Medium Dense to Dense, Brown and Gray, fine to coarse SILTY SAND (SM) , and GRAVEL , Moist. ---Coarse GRAVEL and/or COBBLE within the soil matrix---		SS 3	56	5-7-10 (17)			11				
10				SS 4	44	14-20-18 (38)			5				
15				SS 5	72	14-14-17 (31)			3				
20				SS 6	89	15-30-22 (52)			4				

(Continued Next Page)

CLIENT APP Architecture PROJECT NAME Dayton Central Water Quality Lab
 PROJECT NUMBER D24-048 PROJECT LOCATION Dayton, OH

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
20		Medium Dense to Dense, Brown and Gray, fine to coarse SILTY SAND (SM), and GRAVEL , Moist. ---Coarse GRAVEL and/or COBBLE within the soil matrix--- (continued)											
25		Hard, Brown to Gray, SILTY SANDY CLAY (CL), little gravel [Glacial Till], Moist.		SS 7	100	30-20-25 (45)	4.5		9				

Boring discontinued at 25.0 feet depth
 No groundwater
 Boring caved at 11.2 feet

(Continued Next Page)

CLIENT APP Architecture PROJECT NAME Dayton Central Water Quality Lab
 PROJECT NUMBER D24-048 PROJECT LOCATION Dayton, OH

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
20		Medium Dense to Dense, Brown and Gray, fine to coarse SILTY SAND (SM), and GRAVEL , Moist. ---Coarse GRAVEL and/or COBBLE within the soil matrix--- (continued)											
		Hard, Gray, SILTY SANDY CLAY (CL), little gravel [Glacial Till], Moist.											
25				SS 7	78	19-21-29 (50)	4.5+						

Boring discontinued at 25.0 feet depth
 No groundwater
 Boring caved at 6.3 feet

CLIENT <u>APP Architecture</u>	PROJECT NAME <u>Dayton Central Water Quality Lab</u>
PROJECT NUMBER <u>D24-048</u>	PROJECT LOCATION <u>Dayton, OH</u>
DATE STARTED <u>11/14/24</u> COMPLETED <u>11/14/24</u>	GROUND ELEVATION _____ HOLE SIZE <u>inches</u>
DRILLING CONTRACTOR <u>DHDC</u>	GROUND WATER LEVELS:
DRILLING METHOD <u>Hollow Stem Auger</u>	AT TIME OF DRILLING <u>---</u>
LOGGED BY <u>Daniel</u> CHECKED BY <u>M.O.H</u>	AT END OF DRILLING <u>---</u>
NOTES _____	AFTER DRILLING <u>---</u>

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		TOPSOIL (8")											
		FILL: Dark Brown, CLAYEY SAND , little to some gravel, Moist.		SS 1	100	2-6-6 (12)			12	26	15	11	
		Medium Dense, Brown and Gray, fine to coarse SILTY SAND (SM) , some gravel, Moist.		SS 2	100	4-10-10 (20)			6				
		---Interbedded Reddish Brown, SANDY CLAY layers---											
5		---Coarse GRAVEL and/or COBBLE within the soil matrix---											
		---Moisture content shown is for SANDY CLAY soil---											
				SS 3	56	4-12-18 (30)			22				
		Dense to Very Dense, Brown and Gray, fine to coarse SILTY SAND (SM) , and GRAVEL , Moist.		SS 4	67	11-19-21 (40)			3				9
10		---Coarse GRAVEL and/or COBBLE within the soil matrix---											
				SS 5	61	15-28-18 (46)			3				
15													
				SS 6	83	28-26-16 (42)			3				
20													

(Continued Next Page)

CLIENT APP Architecture **PROJECT NAME** Dayton Central Water Quality Lab
PROJECT NUMBER D24-048 **PROJECT LOCATION** Dayton, OH

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
20													
		Dense to Very Dense, Brown and Gray, fine to coarse SILTY SAND (SM), and GRAVEL , Moist. ---Coarse GRAVEL and/or COBBLE within the soil matrix--- (continued)											
				SS 7	101	50/2"			4				

Boring discontinued at 23.7 feet due to spoon refusal
 No groundwater
 Boring caved at 14.6 feet

**BORING NUMBER B-6**

PAGE 1 OF 2

CLIENT APP Architecture
PROJECT NUMBER D24-048
DATE STARTED 11/12/24 COMPLETED 11/12/24
DRILLING CONTRACTOR DHDC
DRILLING METHOD Hollow Stem Auger
LOGGED BY Daniel CHECKED BY M.O.H
NOTES _____

PROJECT NAME Dayton Central Water Quality Lab
PROJECT LOCATION Dayton, OH
GROUND ELEVATION _____ HOLE SIZE inches
GROUND WATER LEVELS:
AT TIME OF DRILLING ---
AT END OF DRILLING ---
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		TOPSOIL (6")											
		POSSIBLE FILL: Dark Reddish Brown, SILTY CLAY , little gravel, Moist.		SS 1	56	4-6-7 (13)	4.0		20	38	16	22	
		Medium Dense to Dense, Brown and Gray, fine to coarse SILTY SAND (SM) , some gravel, Moist.		SS 2	61	6-10-11 (21)			5				
5		---Coarse GRAVEL and/or COBBLE within the soil matrix---		SS 3	61	10-14-14 (28)			4				
		Dense to Very Dense, Brown and Gray, fine to coarse SILTY SAND (SM) , and GRAVEL , Moist.		SS 4	56	15-15-17 (32)			3				
10		---Coarse GRAVEL and/or COBBLE within the soil matrix---		SS 5	61	31-31-34 (65)			4				
15													
20				SS 6	56	34-34-22 (56)			5				11

(Continued Next Page)

CLIENT APP Architecture PROJECT NAME Dayton Central Water Quality Lab
 PROJECT NUMBER D24-048 PROJECT LOCATION Dayton, OH

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
20													
		Dense to Very Dense, Brown and Gray, fine to coarse SILTY SAND (SM), and GRAVEL , Moist. ---Coarse GRAVEL and/or COBBLE within the soil matrix--- (continued)											
		Hard, Brown, SANDY SILTY CLAY (CL-ML), trace gravel [Glacial Till], Moist.											
25				SS 7	83	20-28-48 (76)			8	18	12	6	55

Boring discontinued at 25.0 feet depth
 No groundwater
 Boring caved at 20.5 feet



BORING NUMBER B-7

PAGE 1 OF 2

CLIENT	APP Architecture	PROJECT NAME	Dayton Central Water Quality Lab
PROJECT NUMBER	D24-048	PROJECT LOCATION	Dayton, OH
DATE STARTED	11/12/24	COMPLETED	11/12/24
DRILLING CONTRACTOR	DHDC	GROUND ELEVATION	
DRILLING METHOD	Hollow Stem Auger	HOLE SIZE	inches
LOGGED BY	Daniel	CHECKED BY	M.O.H
NOTES			
GROUND WATER LEVELS:		AT TIME OF DRILLING ---	
		AT END OF DRILLING ---	
		AFTER DRILLING ---	

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 11/27/24 13:29 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCLPROJECTS\DAYTON CENTRAL WATER QUALITY LAB.GPJ

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		TOPSOIL (8")											
		FILL: Dark Brown, SANDY CLAY , some gravel, Moist. ---Rock fragments in sample #2---		SS 1	61	2-3-3 (6)			13				
5		Medium Dense, Brown and Gray, fine to coarse SILTY SAND (SM), some gravel, Moist. ---Coarse GRAVEL and/or COBBLE within the soil matrix---		SS 2	50	3-3-3 (6)			10				
				SS 3	44	3-7-4 (11)			7				
10				SS 4	50	4-10-11 (21)			4				
		Dense, Brown and Gray, fine to coarse SILTY SAND (SM), and GRAVEL , Moist. ---Coarse GRAVEL and/or COBBLE within the soil matrix--- ---Some high N-values due to the presence of coarse GRAVEL/COBBLE within the soil matrix---		SS 5	61	25-35-47 (82)			3				
15													
20				SS 6	44	18-28-30 (58)			4				

(Continued Next Page)

CLIENT APP Architecture **PROJECT NAME** Dayton Central Water Quality Lab
PROJECT NUMBER D24-048 **PROJECT LOCATION** Dayton, OH

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 11/27/24 13:29 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\DAYTON CENTRAL WATER QUALITY LAB.GPJ

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
20													
		Dense, Brown and Gray, fine to coarse SILTY SAND (SM), and GRAVEL , Moist. ---Coarse GRAVEL and/or COBBLE within the soil matrix--- ---Some high N-values due to the presence of coarse GRAVEL/COBBLE within the soil matrix--- (<i>continued</i>)											
25				SS 7	50	15-21-22 (43)			4				

Boring discontinued at 25.0 feet depth
 No groundwater
 Boring caved at 18.5 feet



2390 Advanced Business Center Drive
Columbus, Ohio 43228
o: 614.527.7656
www.dhdcinc.com

APPENDIX: LABORATORY TEST RESULTS

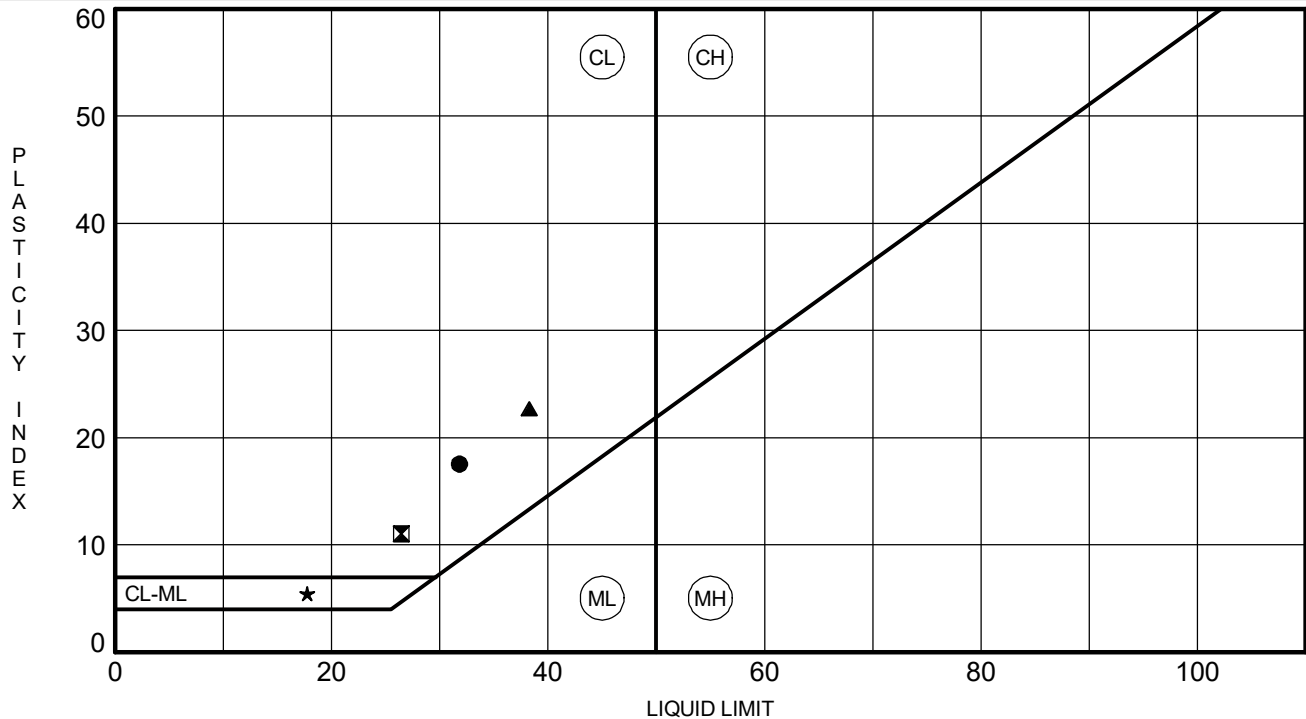
ATTERBERG LIMITS' RESULTS

CLIENT APP Architecture

PROJECT NAME Dayton Central Water Quality Lab

PROJECT NUMBER D24-048

PROJECT LOCATION Dayton, OH

[illegible]

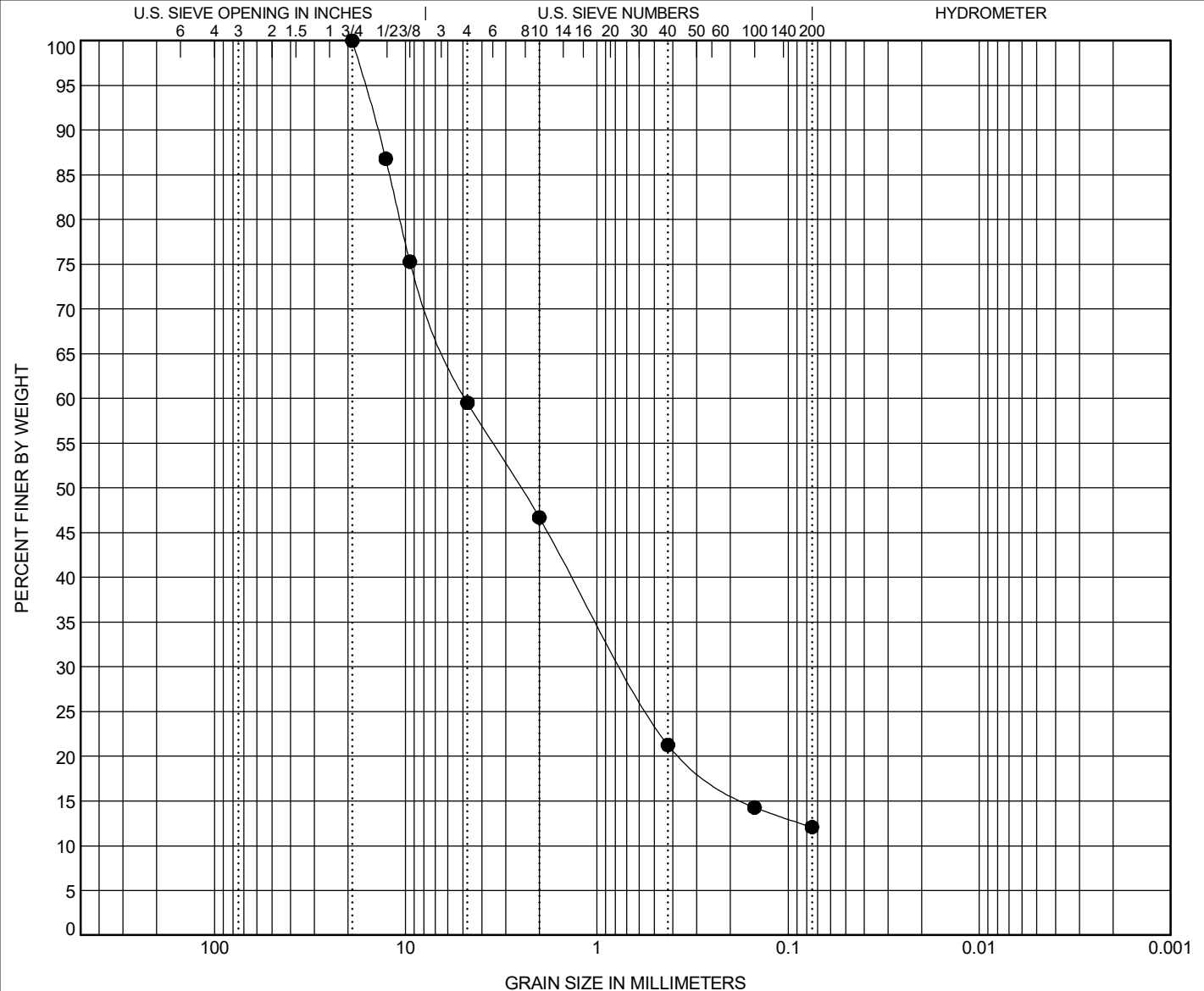
GRAIN SIZE DISTRIBUTION

CLIENT APP Architecture

PROJECT NAME Dayton Central Water Quality Lab

PROJECT NUMBER D24-048

PROJECT LOCATION Dayton, OH



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-1	13.5	SILTY SAND (SM) and GRAVEL								2.79	125.50
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● B-1	13.5	19	4.85	0.723		40.5	47.4	12.1			



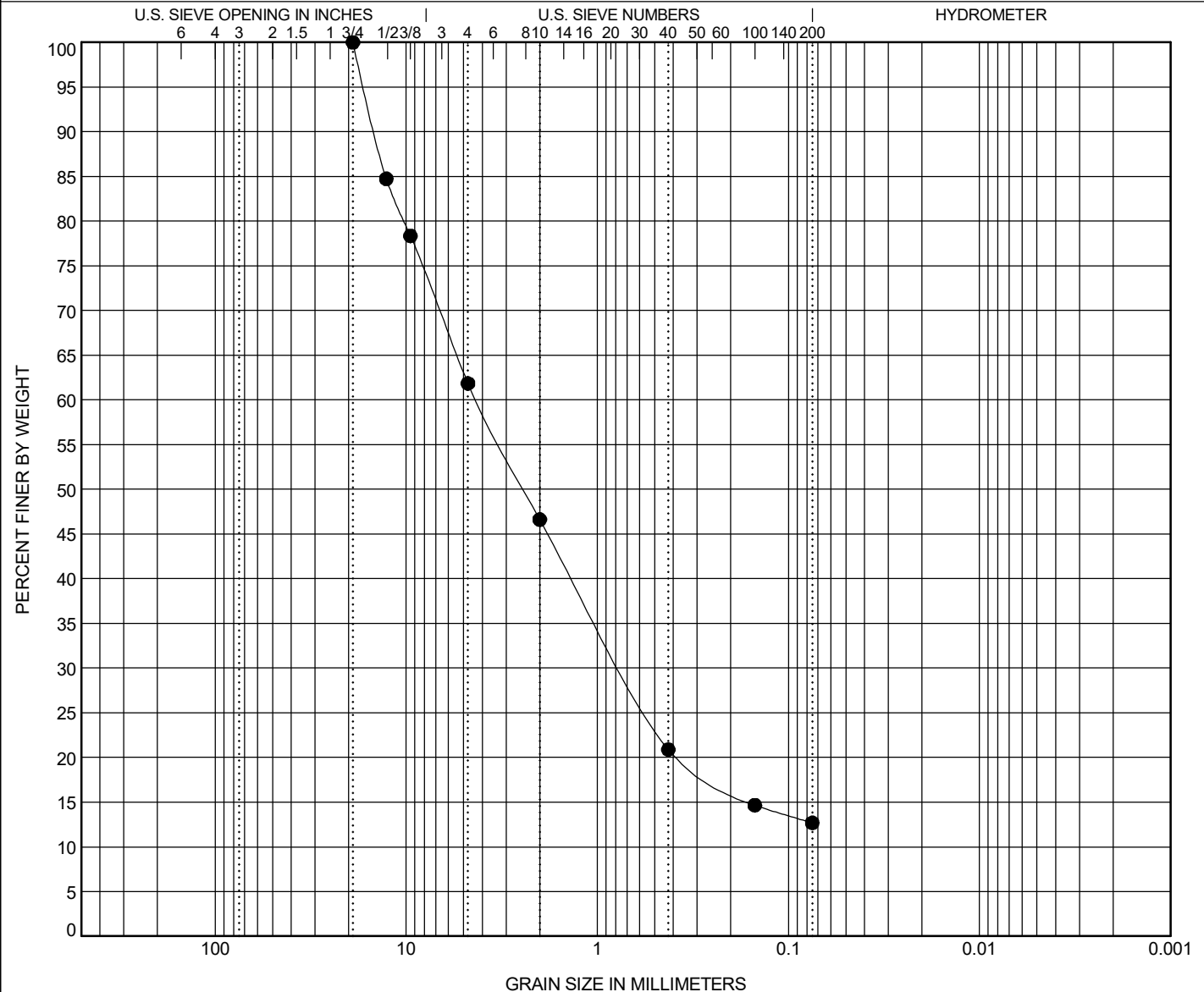
GRAIN SIZE DISTRIBUTION

CLIENT APP Architecture

PROJECT NAME Dayton Central Water Quality Lab

PROJECT NUMBER D24-048

PROJECT LOCATION Dayton, OH



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-4	6.0	SILTY SAND (SM) and GRAVEL									
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● B-4	6.0	19	4.276	0.735		38.1	49.2	12.7			

GRAIN SIZE - GINT STD US LAB.GDT - 11/25/24 13:33 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\DAYTON CENTRAL WATER QUALITY LAB.GPJ



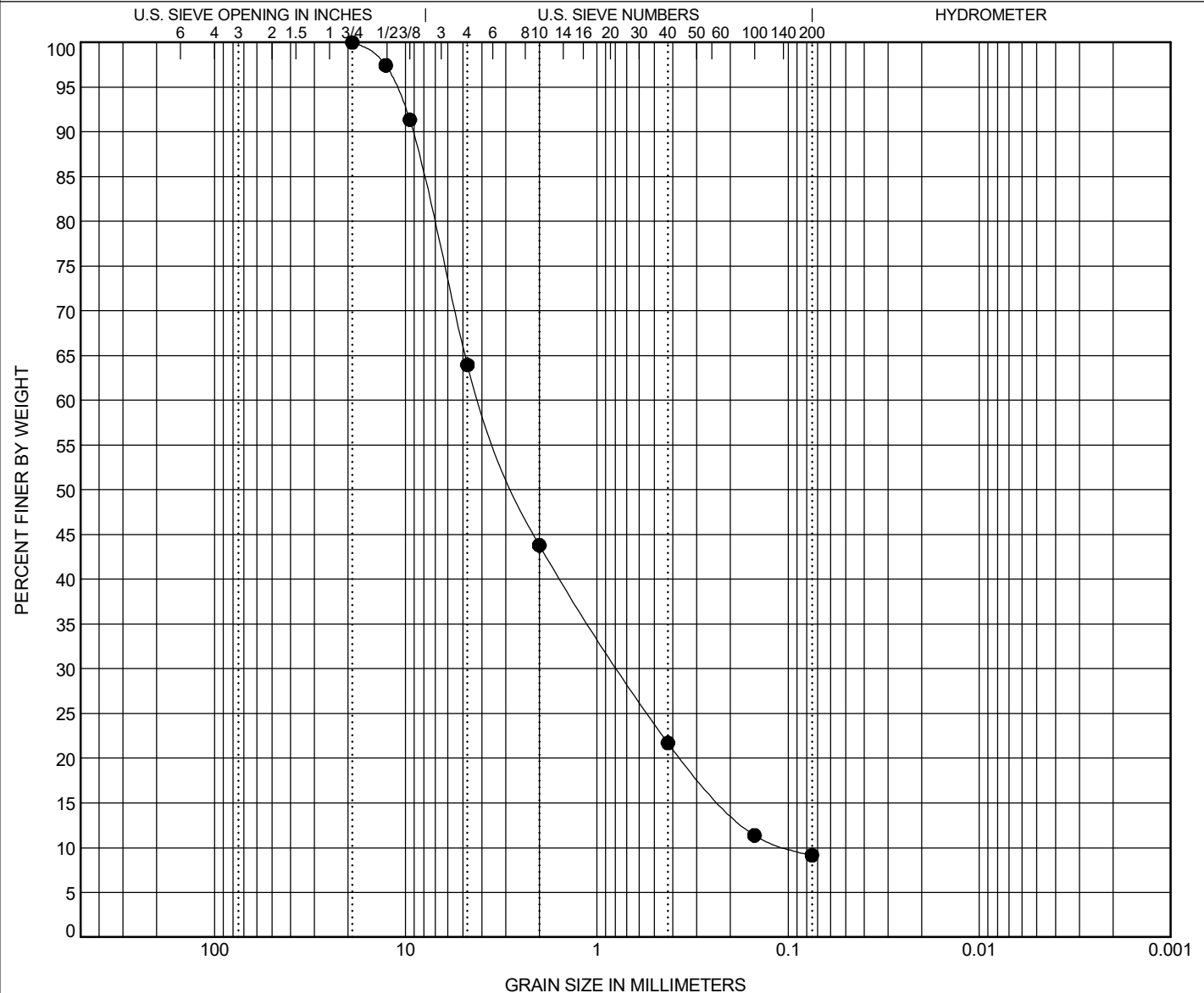
GRAIN SIZE DISTRIBUTION

CLIENT APP Architecture

PROJECT NAME Dayton Central Water Quality Lab

PROJECT NUMBER D24-048

PROJECT LOCATION Dayton, OH



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-5	8.5	SILTY SAND (SM) and GRAVEL								1.48	41.12
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● B-5	8.5	19	4.008	0.76	0.097	36.0	54.8	9.2			

GRAIN SIZE - GINT STD US LAB.GDT - 11/25/24 13:33 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\DAYTON CENTRAL WATER QUALITY LAB.GPJ

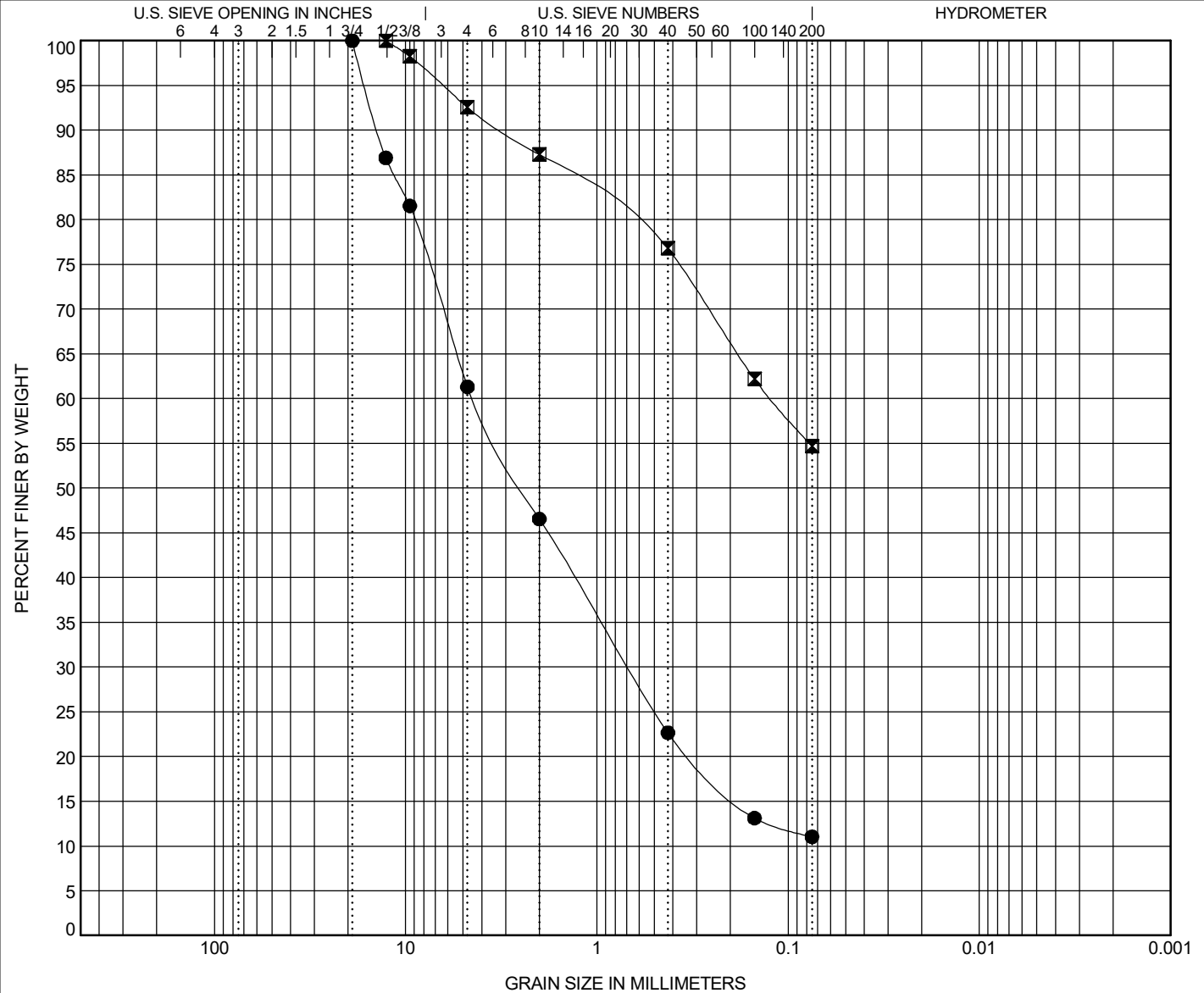
GRAIN SIZE DISTRIBUTION

CLIENT APP Architecture

PROJECT NAME Dayton Central Water Quality Lab

PROJECT NUMBER D24-048

PROJECT LOCATION Dayton, OH



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-6	18.5	SILTY SAND (SM) and GRAVEL								2.00	82.64
☒ B-6	23.5	SANDY SILTY CLAY (CL-ML), trace gravel					18	12	6		
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● B-6	18.5	19	4.396	0.684		38.7	50.3	11.0			
☒ B-6	23.5	12.7	0.123			7.4	37.9	54.7			

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**SECTION 01 1000
SUMMARY**

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: City of Dayton Water Quality Lab Expansion.
- B. Owner: City of Dayton Water Department
 - 1. Owners's Represenative: Liz Zelinski
- C. Architect's Name: App Architecture, Inc. 615 Woodside Drive, Englewood, Ohio 45322.
 - 1. Architect's Representative for inquiries about this project:
Fernando Oseguera, Project Manager.
fernando.oseguera@app-arch.com
Phone: (937)-836-8898
- D. The project consists of renovations to the existing building and two new additions. The new addition to the west of the existing building includes the construction of a new laboratory and support spaces. The addition to the east includes a new conference room and a mechanical room. The work indicated in the Contract Documents to include, but not limited to, civil, architectural, structural, fire protection, plumbing, heating, ventilation and air conditioning, electrical, data and communications systems.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: Project will be constructed under a Single Prime Contractor.

1.03 WORK BY OWNER

- A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Date of Substantial Completion. Some items include:
 - 1. Furnishings.
 - 2. Small equipment.
 - 3. Independent Inspections and Testing.
 - 4. Refer to construction documents for additional items.
- B. Owner will supply and install the following:
 - 1. Refer to the schedules located on the drawings.
- C. Owner will supply the following for installation by Contractor:
 - 1. Refer to the schedules located on the drawings.

1.04 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Owner intends to occupy the Project upon Substantial Completion.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- D. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
 - 1. Locate and conduct construction activities in ways that will limit disturbance to site.
- B. Arrange use of site and premises to allow:

1. Work by Others.
2. Work by Owner.
- C. Provide access to and from site as required by law and by Owner:
 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Time Restrictions:
 1. Limit conduct of especially noisy interior and exterior work to the hours of 6:00 p.m to 5:00 a.m.
 2. Limit conduct of the hours of 7:00 a.m. to 5:00 p.m.
 3. Weekend Hours: As approved by Owner.
 4. Early Morning Hours: As approved by Owner.
- E. Utility Outages and Shutdown:
 1. Limit disruption of utility services to hours the building is unoccupied.
 2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 2 days notice to Owner and authorities having jurisdiction.
 3. Limit shutdown of utility services, arranged at least 24 hours in advance with Owner.
 4. Prevent accidental disruption of utility services to other facilities.

1.06 WORK SEQUENCE

- A. Construct Work in phases
 1. Refer to Drawings for construction phases and sequence of work.
- B. Coordinate construction schedule and operations with Owner and Architect.

1.07 BUILD AMERICA, BUY AMERICA ACT REQUIREMENTS

- A. This project will receive Federal funding. Therefore, products and materials procured for the project must comply with the Build America, Buy America act (BABA). Refer to the City of Dayton General Provisions and Supplemental Specifications for compliance requirements.
- B. The Contractor must maintain a complete list of construction materials, products, and manufacturers' certifications for products used in the project in order to verify (BABA) compliance.

END OF SECTION

**SECTION 01 2100
ALLOWANCES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Contingency allowance.
- B. Building construction permit allowance.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions for general administrative requirements for Change Orders.

1.03 DEFINITIONS

- A. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.04 CONTINGENCY ALLOWANCE

- A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.
- B. Funds will be drawn from the Contingency Allowance only by Change Order.
- C. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.05 BUILDING CONSTRUCTION PERMIT ALLOWANCE

- A. The Construction Permit allowance is designated for the general construction permit only. This allowance must not be used for permits that are the contractor's responsibility.
- B. Funds will be drawn from the Contingency Allowance only by Change Order.
- C. At closeout of the Contract, funds remaining in the Contingency Allowance will be credited to the Owner Change Order.

1.06 ALLOWANCES SCHEDULE

- A. Owner Contingency Allowance: Include a stipulated sum / price of \$1,283,884 for the Owner's use for potential additional scope items during construction.
- B. Building Construction Permit Fee Allowance: \$48,000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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**SECTION 01 2300
ALTERNATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.
- B. Procedures for pricing Alternates.
- C. Documentation of changes to Contract Price and Contract Time.

1.02 RELATED REQUIREMENTS

- A. Document 00 2113 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.

1.03 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.04 SCHEDULE OF ALTERNATES

- A. As noted or shown in the Contract Documents.
 - 1. Alternate No. A-1 - New Vapor Barrier and Gypsum Board at Existing Exterior Walls:

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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**SECTION 01 2500
SUBSTITUTION PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

- A. Section Division 00 - City of Dayton CMS Modifications for Online Bidding document, Instructions to Bidders: Restrictions on timing of substitution requests.
- B. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.
- C. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability.
 - b. Regulatory changes.
 - c. Unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. A Substitution Request for specified installer constitutes a representation that the submitter:
 - 1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.

- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
 - 1. Note explicitly any non-compliant characteristics.
- D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
 - 1. No specific form is required. Contractor's Substitution Request documentation must include the following:
 - a. Project Information:
 - 1) Official project name and number, and any additional required identifiers established in Contract Documents.
 - 2) Owner's, Architect's, and Contractor's names.
 - 3) Use Architect's Substitution Request Form Cover Sheet provided at the end of this section.
 - b. Substitution Request Information:
 - 1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
 - 2) Indication of whether the substitution is for cause or convenience.
 - 3) Issue date.
 - 4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
 - 5) Description of Substitution.
 - 6) Reason why the specified item cannot be provided.
 - 7) Differences between proposed substitution and specified item.
 - c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
 - 1) Physical characteristics.
 - 2) In-service performance.
 - 3) Expected durability.
 - 4) Visual effect.
 - 5) Warranties.
 - 6) Other salient features and requirements.
 - 7) Include, as appropriate or requested, the following types of documentation:
 - (a) Product Data.
 - (b) Samples.
 - (c) Certificates, test, reports or similar qualification data.
 - (d) Drawings, when required to show impact on adjacent construction elements.
 - d. Impact of Substitution:
 - 1) Savings to Owner for accepting substitution.
 - 2) Change to Contract Time due to accepting substitution.
- E. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Submittal Time Restrictions:
 - 1. City of Dayton, Instructions to Bidders: specifies time restrictions and the documents required for submitting substitution requests during the bidding period.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Architect will consider requests for substitutions only within 15 days after date of Agreement.

- B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- C. Submit request for Substitution for Convenience within 14 days of discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
 - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
 - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
 - 3. Bear the costs engendered by proposed substitution of:
 - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
 - b. Other construction by Owner.
 - c. Other unanticipated project considerations.
- D. Substitutions will not be considered under one or more of the following circumstances:
 - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 - 2. Without a separate written request.
 - 3. When acceptance will require revisions to Contract Documents.

3.04 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.
 - 1. Architect's decision following review of proposed substitution will be noted on the submitted form cover sheet.

3.05 ACCEPTANCE

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

3.07 ATTACHMENTS

- A. A facsimile of the Substitution Request Form Cover Sheet (During Construction) required to be used on the Project is included after this section.

END OF SECTION

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SUBSTITUTION REQUEST FORM

DATE:

TIME:

REQUEST NO.:

PROJECT: CITY OF DAYTON
CENTRAL WATER QUALITY LAB EXPANSION

PROPOSED SUBSTITUTION: _____

REQUEST AUTHOR: _____ **REQUIRED REPLY DATE:** _____

REPLY: _____

REPLY AUTHOR: _____ **REPLY DATE:** _____

ATTACHMENTS:

ACTION REQUIRED:

DISTRIBUTION:

END OF SECTION 01 2500

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**SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Web-based project software service.
- C. Preconstruction meeting.
- D. Progress meetings.
- E. Construction progress schedule.
- F. Contractor's daily reports.
- G. Coordination drawings.
- H. Submittals for review, information, and project closeout.
- I. Number of copies of submittals.
- J. Requests for Information (RFI) procedures.
- K. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 00 7200 - General Conditions: Dates for applications for payment.
- B. Section 01 6000 - Product Requirements: General product requirements.
- C. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.
- D. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.
- E. Section 01 9113 - General Commissioning Requirements: Additional procedures for submittals relating to commissioning.
 - 1. Where submittals are indicated for review by both Architect and the Commissioning Provider (CxP), submit one extra and route to Architect first for forwarding to the Commissioning Provider.
 - 2. Where submittals are not indicated to be reviewed by Architect, submit directly to the Commissioning Provider (CxP); otherwise, the procedures specified in this section apply to commissioning submittals.

1.03 PROJECT COORDINATOR

- A. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for site access, traffic, and parking facilities.
- B. During construction, coordinate use of site and facilities through the Project Coordinator.
- C. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- D. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 1000 - Summary.
- E. Coordinate field engineering and layout work under instructions of the Project Coordinator.

- F. Make the following types of submittals to Architect through the Project Coordinator:
1. Requests for Information.
 2. Requests for substitution.
 3. Shop drawings, product data, and samples.
 4. Test and inspection reports.
 5. Design data.
 6. Manufacturer's instructions and field reports.
 7. Applications for payment and change order requests.
 8. Progress schedules.
 9. Coordination drawings.
 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WEB-BASED PROJECT SOFTWARE SERVICE

- A. Web-Based Project Software Service: General Contractor to provide, administer, and use web-based project software to host and manage project communication and documentation.
1. Include, at minimum, the following features:
 - a. Project directory, including Owner, Contractor, subcontractors, Architect, Architect's consultants, and other entities involved in the project. Include names of contact persons and contact information for each entity.
 - b. Access control for each entity and for each workflow process to determine each entity's digital rights to create, modify, view, and print documents.
 - c. Workflow planning, allowing customization of workflow for each project entity.
 - d. Creation, logging, tracking, and notification for project communications required in other Specification Sections, including, but not limited to RFI's, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
 - e. Tracking of project communication statuses in real time, including timestamped response log.
 - f. Procedures for viewing PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
 - g. Processing and tracking of payment applications.
 - h. Processing and tracking of contract modifications.
 - i. Creation and distribution of meeting minutes.
 - j. Document management for drawings, specifications, and coordination drawings, including revision control.
 - k. Management of construction progress photographs.
 - l. Mobile device compatibility.
 - m. Creation of data analytics reports.
 - n. Creation and export of editable logs for software functions. Provide Owner, Architect, and Architect's consultants with rights and ability to download logs when requested.
 2. Provide up to 20 user licenses for use by Owner, Architect, Architect's consultants, and other entities involved in the project.
 3. Comply with the software service's current published licensing agreements.
 4. Training: Provide one-hour, web-based training session for users of software service. Further training is the responsibility of the user.
 - a. Representatives of Owner are scheduled and included in this training.

5. Project Closeout: Provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prohibit further changes after completion of the project.
6. Web-Based Project Software Services: Subject to compliance with the requirements use one of the following:

3.02 PRECONSTRUCTION MEETING

- A. Project Coordinator will schedule a meeting no later than 10 days after the execution of the Agreement.
- B. Attendance Required:
 1. Owner.
 2. Architect.
 3. General Contractor
- C. Agenda:
 1. Execution of Owner-Contractor Agreement.
 2. Submission of executed bonds and insurance certificates.
 3. Distribution of Contract Documents.
 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 5. Submission of initial Submittal schedule.
 6. Designation of personnel representing the parties to Contract, General Contractor and Architect.
 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 8. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-weekly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
 1. General Contractor.
 2. Owner.
 3. Architect.
 4. Contractor's superintendent.
 5. Major subcontractors.
- D. Agenda:
 1. Review minutes of previous meetings.
 2. Review of work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of RFIs log and status of responses.
 7. Maintenance of progress schedule.
 8. Corrective measures to regain projected schedules.
 9. Planned progress during succeeding work period.
 10. Maintenance of quality and work standards.

11. Effect of proposed changes on progress schedule and coordination.
 12. Other business relating to work.
- E. Record minutes and distribute copies within two days after meeting to participants, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.

3.05 DAILY CONSTRUCTION REPORTS

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
- B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
 1. Date.
 2. High and low temperatures, and general weather conditions.
 3. List of subcontractors at Project site.
 4. List of separate contractors at Project site.
 5. Approximate count of personnel at Project site.
 6. Major equipment at Project site.
 7. Material deliveries.
 8. Safety, environmental, or industrial relations incidents.
 9. Meetings and significant decisions.
 10. Unusual events (submit a separate special report).
 11. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
 12. Testing and/or inspections performed.
 13. Signature of Contractor's authorized representative.

3.06 COORDINATION DRAWINGS

- A. Provide information required by Project Coordinator for preparation of coordination drawings and shop drawings.
- B. Review drawings prior to submission to Architect.
- C. Architect and consultants will provide CAD or REVIT files as requested for use in producing coordination drawings.
 1. Agreement and Waiver forms are provided at the end of this section and must be completed and signed as part of any request for digital files.
 2. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute the Agreement and Waiver form.

3.07 REQUESTS FOR INFORMATION (RFI)

- A. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 - 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 - 2. Prepare in a format and with content acceptable to Architect.
- B. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 - 1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 - 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 6000 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 - 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
 - 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
 - a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- C. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
 - 1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 - 2. Owner's, Architect's, and General Contractor's names.
 - 3. Discrete and consecutive RFI number, and descriptive subject/title.
 - 4. Issue date, and requested reply date.
 - 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 - 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 - 7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- D. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- E. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 - 2. Note dates of when each request is made, and when a response is received.

3. Highlight items requiring priority or expedited response.
 4. Highlight items for which a timely response has not been received to date.
- F. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- G. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
 4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.08 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
1. Submit at the same time as the preliminary schedule specified in Section - 01 3216 - Construction Progress Schedule.
 2. Coordinate with Contractor's construction schedule and schedule of values.
 3. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
 4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
 - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.09 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.10 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
1. Design data.
 2. Certificates.

3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions.
 6. Manufacturer's field reports.
 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.11 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.12 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Extra Copies at Project Closeout: See Section 01 7800.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.13 SUBMITTAL PROCEDURES

- A. General Requirements:
1. Use a separate Project Submittal Cover Sheet for each item. Form included at end of this specification section.
 2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
 3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 6. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Upload submittals in electronic form to Electronic Document Submittal Service website.
 7. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.

- b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 15 days.
- 8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
- 9. When revised for resubmission, identify all changes made since previous submission.
- 10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
- 11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
- B. Product Data Procedures:
 - 1. Submit only information required by individual specification sections.
 - 2. Collect required information into a single submittal.
 - 3. Submit concurrently with related shop drawing submittal.
 - 4. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
 - 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 - 2. Do not reproduce Contract Documents to create shop drawings.
 - 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
 - 1. Transmit related items together as single package.
 - 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.14 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
 - 1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.
- D. Architect's and consultants' actions on items submitted for review:
 - 1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Reviewed", or language with same legal meaning.
 - b. "Reviewed as Noted, Resubmission not required", or language with same legal meaning.
 - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
 - c. "Reviewed as Noted, Resubmit for Record", or language with same legal meaning.
 - 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".
 - 1) Resubmit revised item, with review notations acknowledged and incorporated.
- E. Architect's and consultants' actions on items submitted for information:
 - 1. Items for which no action was taken:
 - a. "Received for Record" - to notify the Contractor that the submittal has been received for record only.
 - 2. Items for which action was taken:
 - a. "Reviewed" - no further action is required from Contractor.

- F. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

END OF SECTION

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**Agreement & Waiver
For Transfer and Use of
Architectural Electronic Files**



615 Woodside Drive, Englewood, Ohio 45322

T 937.836.8898 F 937.832.3696

www.app-arch.com

PROJECT: _____

OWNER: _____

You (hereinafter “User”) have requested App Architecture (hereinafter “AA”) provide electronic files, which may include BIM files, (hereinafter “Electronic Files”) for User’s convenience and use in the preparation of shop drawings/coordination drawings related to this project only. AA is willing to accommodate this request subject to the following terms and conditions:

AA and User fully understand that the data contained in these Electronic Files are part of AA’s Instruments of Service, AA shall be deemed the author of the drawings and data, and shall retain all common law, statutory law, and other rights. Modifications to the Electronic Files are to be made only by AA or its Subconsultants through the RFI process. User shall not transfer the Electronic Files to any other party without the express written authorization of AA. These files are not a product and shall not be used by User or anyone else receiving this data through or from User for any other purpose other than as a convenience as described above. AA makes no warranties, either express or implied, of merchantability and fitness for any particular purpose. Furthermore, any description of said Electronic Files shall not be deemed to create an implied or express warranty that such Electronic Files shall conform to said description.

User understands and accepts that Electronic Files deteriorate or can be modified inadvertently or otherwise without authorization by AA. Therefore, AA may remove all indication of its ownership or involvement from these Electronic Files. Furthermore, AA makes no representations as to compatibility, usability or readability of the files resulting from the use of software, application packages, operating systems, or computer hardware differing from those of AA. Nor does AA make any representation that these Electronic Files will have any particular durability or that they will not damage or impair the User’s computer or software.

The User acknowledges that the furnishing of these files in no way relieves the User from the responsibility for the preparation of shop drawings or other schedules as required by the Contract between the Contractor and the Owner including the need to check, confirm and coordinate the work with that of other contractors for this project.

User understands that these Electronic Files are not contract documents, they do not contain all the information of the contract documents. Significant differences may exist between these Electronic Files and corresponding hard copy documents due to addenda, change orders, revisions, layer visibility or other reasons. AA makes no representations as to the accuracy or completeness of these Electronic Files. User understands and agrees that in the event of a conflict, printed hard copy drawings and specifications issued by AA shall take precedence over Electronic Files. User understands and agrees that User alone is completely responsible, without limitation, to check and otherwise confirm the accuracy of all data on these Electronic Files. The User recognizes that the

AA does not have, and will not have, any duty or obligation to advise or give notice to the User of any future revisions or modifications to the originating Electronic Files.

The User acknowledges that the Electronic Files provided by AA are a graphical representation of the building in order to generate two-dimensional industry standard drawings. A Revit model will contain both 2D and 3D components. The data contained in the Electronic Files may not be 100% accurate and should not be used for dimensional control, building layout or similar purposes. Additionally, the User acknowledges that the information in the Electronic Files should be use for comparative purposes only and shall not be relied upon for accurate quantity estimates.

The User shall assume all risks and liabilities resulting from use of these Electronic Files. User agrees to make no claims and hereby waives, to the fullest extent permitted by law, any claims or causes of action of any nature whatsoever, including claims for consequential damages, against AA, its officers, directors, employees, agents, or sub-consultants which may arise out of or in connection with the use of the Electronic Files. Furthermore, User shall, to the fullest extent permitted by law, indemnify, defend, and hold harmless AA, its officers, directors, employees, agents, or sub-consultants from and against all claims, damages, losses, and expenses, including attorney fees, arising out of, or related to User's, or anyone else receiving this data through or from User, use of the Electronic Files. If User reproduces the Electronic Files or creates a derivative work based upon them, User shall remove or completely obliterate any professional seals, logos, and other indications on the documents of the identity of AA, its officers, directors, employees, agents, or sub-consultants.

Neither this Agreement nor use of these files shall alter the contractor's Contract for Construction in any way.

ELECTRONIC FILE FORMAT (SELECT ONE):

☐ .DWG Format – List drawing sheets requested:

☐ Revit Project Model (Model only, no Views included, no specific LOD):

The User agrees that the AA shall have no responsibility whatsoever for problems of any nature arising from transmitting and storing electronic files at a User requested FTP site or project management site or the conversion of the Electronic Files by the User or others for use in non-native applications. AA will not provide Electronic Files in compressed formats. The User agrees to accept the files in the format provided by AA, and that the User's conversion or electronic file storage at the User's at the User's requested site, shall be at the User's sole risk.

AA, at its sole discretion, may modify the Electronic Files before they are provided to the User. Such modifications may include, but are not limited to, removal of certain information. AA, at its sole discretion, may refuse to provide some or all Electronic Files requested by the User.

The availability of Electronic Files that were not prepared by AA is subject to the consent of the Owner and/or consultant that prepared those Electronic Files. AA will not negotiate with the Owner or consultant or repeatedly solicit the Owner or consultant to obtain consent. Neither this

Agreement and Waiver for Transfer and Use of Electronic Files nor any such separate Consultant's consent may be assigned or transferred by the User to any other person or entity.

USER (FIRM NAME): _____ **DATE:** _____

ADDRESS: _____

CITY: _____ **STATE:** _____ **ZIP:** _____

PHONE NO.: _____

SIGNED: _____ **EMAIL:** _____

NAME/TITLE (PRINTED): _____

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Project Submittal Cover Sheet

Date: _____

Submittal Number _____

Submittal Name: _____

Spec Section No: _____

Project: City of Dayton
Central Water Quality Lab Expansion

General Contractor: _____

Subcontractor: _____ Supplier Name: _____

Architect: App Architecture
615 Woodside Drive
Englewood, OH 45322

General Contractor's Approval Stamp

Architect's/Engineer's Action Stamp

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**SECTION 01 4000
QUALITY REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Contractor's design-related professional design services.
- F. Control of installation.
- G. Mock-ups.
- H. Tolerances.
- I. Manufacturers' field services.
- J. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Document 00 3100 - Available Project Information: Soil investigation data.
- B. Section 01 3000 - Administrative Requirements: Submittal procedures.
- C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).
- B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2026.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2023.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025a.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.
- G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.
- H. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2021.

1.04 DEFINITIONS

- A. Contractor's Professional Design Services (Delegated Design Services): Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
 - 1. Design Services Types Required:
 - a. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project.

Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

- B. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.05 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services (delegated design services) are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
 - 1. Submit a Request for Interpretation to Architect if the criteria indicated are not sufficient to perform required design services.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
 - 1. Structural Design of Steel Connections: As described in Section 05 1200 - Structural Steel Framing.
 - 2. Structural Design of Metal Framing: As described in Section 05 4000 - Cold-Formed Metal Framing.

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
 - 1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
 - a. Full name.
 - b. Professional licensure information.
 - c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.
- C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
 - 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
 - 2. Include required product data and shop drawings.
 - 3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
 - 4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- D. Test Reports: After each test/inspection, promptly submit copies of report to Architect and to Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.

- k. When requested by Architect, provide interpretation of results.
- 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
 - 1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.07 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 - 1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.
- B. Designer Qualifications: Where professional engineering design services (Delegated Design) and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.08 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.09 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ and pay for services of an independent testing agency to perform special tests and inspections required by authorities having jurisdiction as the responsibility of the Owner, as indicated in the Statement of Special Inspections included at the end of this Section and as follows:
 - 1. Notifying Architect and Contractor promptly of any irregularities and deficiencies observed in the Work during performance of its services.

2. Submitting a certified written report of each test, inspection, and similar quality control services to Architect with a copy to Contractor and to authorities having jurisdiction.
 3. Retesting and reinspecting corrected Work.
- B. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
- C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- D. Contractor Employed Agency:
1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
1. Provide qualified personnel at site. Cooperate with Architect and Construction Manager in performance of services.
 2. Perform specified sampling and testing of products in accordance with specified standards.
 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 5. Perform additional tests and inspections required by Architect.
 6. Submit reports of all tests/inspections specified.

- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Construction Manager Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.04 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

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**SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dewatering
- B. Temporary utilities.
- C. Temporary telecommunications services.
- D. Temporary sanitary facilities.
- E. Temporary Controls: Barriers, Fencing, Enclosures.
- F. Temporary Fire Protection.
- G. Security requirements.
- H. Vehicular access and parking.
- I. Waste removal facilities and services.
- J. Project identification sign.
- K. Field offices.

1.02 DEWATERING

- A. Provide temporary means and methods for dewatering all temporary facilities and controls. Comply with requirements of authorities having jurisdiction.
- B. Maintain temporary facilities in operable condition.

1.03 TEMPORARY UTILITIES

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes. Construction Manager to coordinate installation, removal, and use charges. Costs to be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. New permanent facilities may be used.

1.04 ELECTRONIC COMMUNICATION SERVICES

- A. Provide, maintain, and pay for a secure WiFi wireless connection to internet services to field office at time of project mobilization. Include provisions for access to relevant parties including but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Telecommunications services shall include:

1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.06 TEMPORARY CONTROLS: BARRIERS, FENCING, ENCLOSURES

- A. BARRIERS

1. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
 - a. Provide warning sites and lights as required by authorities having jurisdiction.
 2. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
 3. Provide protection for plants designated to remain. Replace damaged plants.
 4. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.
 5. Traffic Controls: Comply with requirements of authorities having jurisdiction.
- B. FENCING
1. Construction: Commercial grade chain link fence.
 2. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.
 - a. Extent of Fence: As indicated on the Drawings.
- C. EXTERIOR ENCLOSURES
1. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.07 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Aluminum framing and Shatter-resistant twin-wall polycarbonate panels with closed joints and sealed edges at intersections with existing surfaces.
1. Class A smoke resistant.
- C. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
1. Locations of dust-control partitions at each phase of work.
 2. HVAC system isolation schematic drawing.
 3. Location of proposed air-filtration system discharge.
 4. Waste-handling procedures.
 5. Other dust-control measures

1.08 NOISE AND VIBRATION CONTROL PLAN:

- A. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:
1. Methods used to meet the goals and requirements of the Owner.
 2. Concrete cutting method(s) to be used.
 3. Location of construction devices on the site.
 4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
 5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.
 6. Indicate locations of sensitive lab areas or other areas requiring special attention as identified by Owner. Indicate means for complying with Owner's requirements

1.09 TEMPORARY FIRE PROTECTION

- A. 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 protection program.
 - 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.

1.10 STORAGE AND FABRICATION SHEDS

- A. Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

1.11 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.12 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.13 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.14 PROJECT IDENTIFICATION

- A. Provide project identification sign of design and construction indicated on drawings.
- B. Erect on site at location indicated.
- C. No other signs are allowed without Owner permission except those required by law.
 - 1. Provide other temporary signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - 2. Maintain and touch up signs, so they are legible at all times.

1.15 FIELD OFFICES

- A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

- B. Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
- C. Provide space for Project meetings, with table and chairs to accommodate 10 persons.
- D. Locate offices near the construction site, as coordinated with owner.

1.16 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 6000
PRODUCT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations.
- F. Procedures for Owner-supplied products.
- G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Identification of Owner-supplied products.
- B. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- C. Section 01 4000 - Quality Requirements: Product quality monitoring.
- D. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 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.
- 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.

1.04 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. See Section 01 4000 - Quality Requirements, for additional source quality control requirements.
- C. Use of products having any of the following characteristics is not permitted:
 - 1. Made using or containing CFC's or HCFC's.
- D. Where other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions, as defined in Section 01 6116.
 - 2. If wet-applied, have lower VOC content, as defined in Section 01 6116.

2.03 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.
- D. Products Specified as Basis-of-Design: Submit substitution requests for unnamed products to Architect for evaluation.

2.04 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

- A. See Section 01 2500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

- A. See Section 01 1000 - Summary for identification of Owner-supplied products.
- B. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.
- C. Contractor's Responsibilities:
 - 1. Review Owner reviewed shop drawings, product data, and samples.
 - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
 - 3. Handle, store, install and finish products.

4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.
 1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.
- F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- G. For exterior storage of fabricated products, place on sloped supports above ground.
- H. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- I. Comply with manufacturer's warranty conditions, if any.
- J. Do not store products directly on the ground.
- K. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- L. Prevent contact with material that may cause corrosion, discoloration, or staining.
- M. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- N. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

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**SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittals procedures.
- B. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
- C. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.
- D. Section 01 5000 - Temporary Facilities and Controls: Temporary interior partitions.
- E. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
- F. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
- G. Section 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.

1.05 QUALIFICATIONS

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.06 PROJECT CONDITIONS

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- B. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- C. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

1.07 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Control datum for survey is that indicated on drawings.
- E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- H. Utilize recognized engineering survey practices.
- I. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- J. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.

2. Grid or axis for structures.
 3. Building foundation, column locations, ground floor elevations.
 4. Controlling lines and levels required for mechanical and electrical trades.
- K. Periodically verify layouts by same means.
- L. Maintain a complete and accurate log of control and survey work as it progresses.
- M. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on limited field observation and original construction documents only.
 1. Verify that construction and utility arrangements are as indicated.
 2. Report discrepancies to Architect before disturbing existing installation.
 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 1. Provide, erect, and maintain temporary dustproof partitions of construction indicated on drawings .
- C. Remove existing work as indicated and as required to accomplish new work.
 1. Remove items indicated on drawings.
 2. Relocate items indicated on drawings.
 3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.

- b. Provide temporary connections as required to maintain existing systems in service.
- 4. Verify that abandoned services serve only abandoned facilities.
- 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- E. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
- F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
- G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- H. Refinish existing surfaces as indicated:
 - 1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 - 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- I. Clean existing systems and equipment.
- J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- K. Do not begin new construction in alterations areas before demolition is complete.
- L. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-complying work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.
- J. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
- G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- H. Prohibit traffic from landscaped areas.
- I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.
- J. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 SYSTEM STARTUP

- A. Coordinate with requirements of Section 01 9113 - General Commissioning Requirements.
- B. Coordinate schedule for start-up of various equipment and systems.
- C. Notify Architect and Owner seven days prior to start-up of each item.
- D. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- E. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

- F. Verify that wiring and support components for equipment are complete and tested.
- G. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- H. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- I. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

- A. See Section 01 7900 - Demonstration and Training.

3.12 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

3.13 FINAL CLEANING

- A. Execute final cleaning prior to Substantial Completion.
- B. Use cleaning materials that are nonhazardous. Use materials recommended by manufacturer or fabricator of the surface to be cleaned.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

END OF SECTION

SECTION 01 7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Contractor Reporting Responsibilities: Submit periodic Waste Disposal Reports; report landfill disposal, incineration, recycling, salvage, and reuse regardless of to whom the cost or savings accrues; use the same units of measure on required reports.
- E. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
- F. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- D. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
 - 1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 - 2. Submit Report on a form acceptable to Owner.
 - 3. Landfill Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - 4. Incinerator Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project delivered to incinerators.
 - c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - 5. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
 - 6. Material Reused on Project: Include the following information for each:
 - a. Identification of material and how it was used in the project.

- b. Amount, in tons or cubic yards (cubic meters).
 - c. Include weight tickets as evidence of quantity.
- 7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1. Prebid meeting.
 - 2. Preconstruction meeting.
 - 3. Regular job-site meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. Provide containers as required.
 - 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 - 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

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**SECTION 01 7800
CLOSEOUT SUBMITTALS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 3. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.

6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 1. Manufacturer's name and product model and number.
 2. Product substitutions or alternates utilized.
 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 1. Measured depths of foundations in relation to finish first floor datum.
 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 4. Field changes of dimension and detail.
 5. Details not on original Contract drawings.
- G. Submit PDF electronic files of scanned record prints, specifications and product data, including addenda and contract modifications.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 1. Product data, with catalog number, size, composition, and color and texture designations.
 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - 1. Include HVAC outdoor and exhaust air damper calibration strategy.
 - a. Include provisions which ensure that full closure of dampers can be achieved.
 - 2. Include Carbon Dioxide Monitoring Protocol.
 - 3. Include Carbon Monoxide Monitoring Protocol.
 - 4. Include Frost Mitigation Strategy for ventilation heat-recovery system.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports.
- P. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Operation and maintenance data.
 - c. Field quality control data.
 - d. Photocopies of warranties and bonds.
- K. 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: Bookmark individual documents base 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.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- I. 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 the beginning of each document.

END OF SECTION

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**SECTION 01 7900
DEMONSTRATION AND TRAINING**

PART 1 GENERAL

1.01 SUMMARY

- A. Demonstration of products and systems where indicated in specific specification sections.

1.02 RELATED REQUIREMENTS

- A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.
- B. Section 01 9113 - General Commissioning Requirements: Additional requirements applicable to demonstration and training.
- C. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Submit to Architect for transmittal to Owner.
 - 2. Submit not less than four weeks prior to start of training.
 - 3. Revise and resubmit until acceptable.
 - 4. Provide an overall schedule showing all training sessions.
 - 5. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.
 - e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - g. Media to be used, such as slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
 - 1. Include applicable portion of O&M manuals.
 - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- D. Training Reports:
 - 1. Identification of each training session, date, time, and duration.
 - 2. Sign-in sheet showing names and job titles of attendees.
 - 3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
 - 4. Include Commissioning Authority's formal acceptance of training session.
- E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
 - 1. Format: DVD Disc.

2. Label each disc and container with session identification and date.

1.04 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.
- C. Demonstration may be combined with Owner personnel training if applicable.
- D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

- A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.
- B. Conduct training on-site unless otherwise indicated.
- C. Owner will provide classroom and seating at no cost to Contractor.
- D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
- E. Provide training in minimum two hour segments.
- F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.
- G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 3. Typical uses of the O&M manuals.

- I. Product- and System-Specific Training:
 - 1. Review the applicable O&M manuals.
 - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 - 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 - 6. Discuss common troubleshooting problems and solutions.
 - 7. Discuss any peculiarities of equipment installation or operation.
 - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 - 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 - 10. Review spare parts and tools required to be furnished by Contractor.
 - 11. Review spare parts suppliers and sources and procurement procedures.
- J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

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**SECTION 01 9113
GENERAL COMMISSIONING REQUIREMENTS**

PART 1 GENERAL

1.01 SUMMARY

- A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
 - 1. Verify that the work is installed in accordance with Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
 - 2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
 - 3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
 - 4. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.
- B. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.
- C. The Commissioning Authority is employed by Owner.

1.02 SCOPE OF COMMISSIONING

- A. The following are to be commissioned:
- B. HVAC System, including:
 - 1. Air Handler
 - 2. Boilers
 - 3. Air Cooled Chiller
 - 4. Pumps
 - 5. Terminal Units
 - 6. Exhaust Fans
 - 7. DDC Controls
- C. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.03 RELATED REQUIREMENTS

- A. Section 01 7800 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.
- B. Section 23 0800 - Commissioning of HVAC: HVAC control system testing; other requirements.

1.04 REFERENCE STANDARDS

- A. ASHRAE Std 202 - The Commissioning Process Requirements for New Buildings and New Systems; 2024.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:

1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architect; in that case, submit to Architect first.
 2. Submit one copy to the Commissioning Authority, not to be returned.
 3. Make commissioning submittals on time schedule specified by Commissioning Authority.
 4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2010 preferred.
 5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.
- B. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:
1. Manufacturer's product data, cut sheets, and shop drawings.
 2. Manufacturer's installation instructions.
 3. Startup, operating, and troubleshooting procedures.
 4. Fan and pump curves.
 5. Factory test reports.
 6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.
- C. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.
- D. Startup Plans and Reports.
- E. Completed Prefunctional Checklists.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

- A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F (0.3 degree C) and resolution of plus/minus 0.1 degree F (0.05 degree C).
 2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
 3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.
- C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.
- D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

- A. Commissioning Authority has prepared the Commissioning Plan.
 - 1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
 - 2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.
- B. Contractor is responsible for compliance with the Commissioning Plan.
- C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.
- D. Commissioning Schedule:
 - 1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
 - 2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
 - 3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
 - 4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 STARTUP PLANS AND REPORTS

- A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.
- B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.
- C. Submit directly to the Commissioning Authority.

3.03 PREFUNCTIONAL CHECKLISTS

- A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
 - 1. No sampling of identical or near-identical items is allowed.
 - 2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
 - 3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
 - a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
 - b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
 - c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
 - d. Serial number of installed unit.
 - e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer's start-up checklist items and minor testing.
 - f. Sensor and actuator calibration information.
- B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.

1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
 2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
 3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
 4. If any Checklist line item is not relevant, record reasons on the form.
 5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.
 6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
 7. Submit completed Checklists to Commissioning Authority within two days of completion.
- C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.
 2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
 3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
 4. When asked to review the proposed Checklists, do so in a timely manner.
- D. Commissioning Authority Witnessing: Required for:
1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
 2. A sampling of non-primary equipment, as allowed by the commissioning plan.
- E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.04 FUNCTIONAL TESTS

- A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.
- B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.
- C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.
- D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
 2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.

3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
 4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
 5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.
- E. Functional Test Procedures:
1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
 2. Examples of Functional Testing:
 - a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
 - b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
 - c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.
 - d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.
- F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.05 SENSOR AND ACTUATOR CALIBRATION

- A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
- B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.
- C. All Sensors:
1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
 2. Verify that sensors with shielded cable are grounded only at one end.
 3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F (0.1 degree C) of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
 4. Tolerances for critical applications may be tighter.
- D. Sensors Without Transmitters - Standard Application:
1. Make a reading with a calibrated test instrument within 6 inches (150 mm) of the site sensor.
 2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
 3. If not, install offset, calibrate or replace sensor.

- E. Sensors With Transmitters - Standard Application.
 - 1. Disconnect sensor.
 - 2. Connect a signal generator in place of sensor.
 - 3. Connect ammeter in series between transmitter and building automation system control panel.
 - 4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
 - 5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
 - 6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
 - 7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
 - 8. Reconnect sensor.
 - 9. Make a reading with a calibrated test instrument within 6 inches (150 mm) of the site sensor.
 - 10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
 - 11. If not, replace sensor and repeat.
 - 12. For pressure sensors, perform a similar process with a suitable signal generator.
- F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
 - 1. Watthour, Voltage, Amperage: 1 percent of design.
 - 2. Pressure, Air, Water, Gas: 3 percent of design.
 - 3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F (0.2 degree C).
 - 4. Relative Humidity: 4 percent of design.
 - 5. Barometric Pressure: 0.1 inch of Hg (340 Pa).
 - 6. Flow Rate, Air: 10 percent of design.
 - 7. Flow Rate, Water: 4 percent of design.
 - 8. AHU Wet Bulb and Dew Point: 2.0 degrees F (1.1 degrees C).
- G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.
- H. Valve/Damper Stroke Setup and Check:
 - 1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
 - 2. Set pump/fan to normal operating mode.
 - 3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
 - 4. Command valve/damper to open; verify position is full open and adjust output signal as required.
 - 5. Command valve/damper to a few intermediate positions.
 - 6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
- I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
 - 1. With full pressure in the system, command valve closed.
 - 2. Use an ultra-sonic flow meter to detect flow or leakage.

3.06 TEST PROCEDURES - GENERAL

- A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
- B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

- C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
 - 1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
 - 2. Sampling is not allowed for:
 - a. Major equipment.
 - b. Life-safety-critical equipment.
 - c. Prefunctional Checklist execution.
 - 3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
 - 4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
 - 5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
 - 6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
 - 7. If YY percent of the units in the second sample fail, test all remaining identical units.
 - 8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.
- D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").
- E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.
- F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.
- G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.
- H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.
- I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
 - 1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority's request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
 - 2. Other points will be monitored by the Commissioning Authority using dataloggers.
 - 3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
 - 4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
 - 5. Graphical output is desirable and is required for all output if the system can produce it.
 - 6. Monitoring may be used to augment manual testing.

3.07 OPERATION AND MAINTENANCE MANUALS

- A. See Section 01 7800 - Closeout Submittals for additional requirements.
- B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

- C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

END OF SECTION

**SECTION 02 4100
DEMOLITION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 1000 - Summary: Work sequence requirements.
- C. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- E. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

1.03 DEFINITIONS

- A. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.
- C. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.
- D. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.04 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

PART 3 EXECUTION

2.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with requirements in Section 01 7000.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 4. Provide, erect, and maintain temporary barriers and security devices.

5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 7. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
 8. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
 9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- C. Do not begin removal until receipt of notification to proceed from Owner.
- D. Protect existing structures and other elements to remain in place and not removed.
1. Provide bracing and shoring.
 2. Prevent movement or settlement of adjacent structures.
 3. Stop work immediately if adjacent structures appear to be in danger.
- E. Hazardous Materials:
1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.
 2. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.

2.02 EXISTING UTILITIES

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

2.03 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
1. Verify construction and utility arrangements are as indicated.
 2. Report discrepancies to Architect before disturbing existing installation.
 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from areas that remain occupied.
1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.

- D. Remove existing work as indicated and required to accomplish new work.
 - 1. Remove items indicated on drawings.
- E. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. See Section 01 1000 - Summary for limitations on outages and required notifications.
 - 4. Verify that abandoned services serve only abandoned facilities before removal.
 - 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.
- F. Protect existing work to remain.
 - 1. Prevent movement of structure. Provide shoring and bracing as required.
 - 2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch to match new work.

2.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove materials not to be reused on site; comply with requirements of Section 01 7419 - Waste Management.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.
- E. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction

END OF SECTION

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SECTION 02 8213- ASBESTOS SURVEY REPORT



Environmental Testing, LLC

"Protecting You With Our Experience"

PRE-RENOVATION ASBESTOS SURVEY REPORT

**City of Dayton Department of Water
Administration and Laboratory Building**

3210 Chuck Wagner Lane
Dayton, Ohio 45414

Prepared for:

Gonzalez

111 West First Street, Suites 915-917
Dayton, Ohio 45402
(419) 722-3879

Report Date: September 9, 2025

Project Number: 25-296-0730

Prepared by:

Dayton Environmental Testing, LLC

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September 9, 2025

Mr. David Ramsey, P.E.
Project Manager
Gonzalez
111 West First Street, Suites 915-917
Dayton, Ohio 45402
(419) 722-3879
dramsey@gocos.net

**Re: Pre-Renovation Asbestos Survey Report
City of Dayton Department of Water
Miami Treatment Plant – Administration and Laboratory Building
3210 Chuck Wagner Lane
Dayton, Ohio 45414**

DET Project Number: 25-296-0730

Dear Mr. Ramsey,

Dayton Environmental Testing, LLC (DET) has prepared this report to document the purpose, scope, methodology, and results of the Pre-Renovation Asbestos Survey completed for the Administration and Laboratory Building located at 3210 Chuck Wagner Lane in Dayton, Ohio (Project Site).

PURPOSE AND SCOPE

The National Emission Standards for Hazardous Air Pollutants (NESHAP) 40 CFR Part 61, Subpart M and the Ohio Administrative Code (OAC) Chapter 3745-20 both require the owner or operator of any renovation operation have the affected facility or part of the facility where a renovation operation will occur thoroughly inspected for asbestos, prior to the commencement of the renovation. In Ohio, this inspection must be performed by a certified Asbestos Hazard Evaluation Specialist.

Gonzalez (Client) requested that DET to perform a pre-demolition asbestos survey of the Control Laboratory located at the Project Site. This survey is strictly limited to the Control Laboratory room as depicted on the Floor Plan Sketch in Attachment C. All other areas of the building are excluded from this survey.

INSPECTION METHODOLOGY

This assessment was performed by DET Project Manager and Ohio-certified Asbestos Hazard Evaluation Specialist Kenneth Lee between August 18, 2025 and September 2, 2025.

Samples were randomly collected from selected homogeneous areas sampled in accordance with the sampling procedures described under AHERA. Each sample was collected and placed in a clean, sealable vial or sealed bag and labeled with a unique sample identification number. This sample number was recorded on an Asbestos Bulk Sampling Log and the sample vial or bag. Supplemental information was also recorded on the Asbestos Bulk Sampling Log, including inspection date, the building name (or number), a brief description and location of the sample, and the type of material sampled (e.g., ceiling tile). The Asbestos Bulk Sampling Log is included in Attachment B.

LABORATORY ANALYSIS

Samples collected by DET during this assessment were transported, under chain of custody, to Schneider Laboratories Global, Inc. (Schneider) in Richmond, Virginia for analysis. Schneider is fully accredited by the National Voluntary Laboratory Accreditation Program (NVLAP # 101150-0), the agency sponsored by the National Institute of Standards and Technology providing EPA accreditation of laboratories analyzing bulk samples for asbestos content by Polarized Light Microscopy (PLM) under AHERA.

Bulk samples were analyzed for asbestos content using EPA Method 600/M4-82/020, and when applicable EPA Method 600/R-93/116. Bulk sample analysis incorporates the use of stereoscopic microscopy and PLM coupled with dispersion staining. The analytical methods listed above, which the EPA currently recommends for the determination of asbestos in bulk samples of friable insulation materials, can be used for qualitative identification of six (6) morphologically different types of asbestos fibers: chrysotile, amosite, crocidolite, anthophyllite, tremolite, and actinolite asbestos.

The EPA method specifies that the asbestos content in a bulk sample shall be estimated and reported as a finite percentage (rounded to the nearest percent) within the range of 0 to 100. Minute quantities of asbestos in bulk samples may be reported as "trace" or less than 1 percent (<1%). The analytical method determined the "*area percent*" asbestos or the percentage of the area of a microscopic field of view that is occupied by asbestos fibers.

Under NESHAP, if bulk analysis indicates that a sample to be less than ten percent asbestos by visual estimation the material can either be assumed ACM or reanalyzed using PLM point counting procedures. If conducted, the analytical results of the PLM point counting are used to determine whether or not the material is ACM, rather than the results of the original PLM bulk analysis.

The results of bulk samples are reported in a standard written laboratory report. The written report includes the client's name, the laboratory identification numbers assigned to each bulk sample upon receipt by the laboratory sample custodian, and the sample number assigned to each bulk sample during the building inspection. The composition of the bulk sample is reported in percentages of asbestos (i.e., chrysotile, amosite, crocidolite, or other) and non-asbestos (i.e., cellulose, fiberglass, synthetic, or other) components.

SUMMARY OF ASBESTOS

Confirmed ACM

PLM bulk analysis indicated that asbestos was not detected in any of the samples collected from the Project Site.

Assumed ACM

The following components could not be thoroughly inspected for ACM without causing significant damage or compromising the integrity of the item. As a result, the following materials are assumed to be ACM:

- Pipe flange gaskets (7 and 9 inch)
- Door components (e.g., insulation, glazing compound, gaskets)
- Roofing materials
- Insulation inside cabinet doors and drawer fronts
- Mastics associated with the laboratory counters, back splashes, and drying racks
- Electrical systems components
- Flexible HVAC duct connector cloth
- Internal boiler components
- Elevator door insulation

Additional details of the materials assessed for asbestos during this asbestos inspection are summarized on the Asbestos Inspection and Assessment Summary in Attachment A. This summary includes where the material is located, material color, material description, the analytical result, and the estimated quantities of ACM, if applicable.

CONCLUSIONS AND RECOMMENDATIONS

Once the building has been vacated, but prior to the start of renovation activities, all Assumed ACMs must be thoroughly assessed and sampled by an Ohio-certified Asbestos Hazard Evaluation Specialist to determine whether they are indeed ACM. Alternatively, they must be treated and removed as ACM by an Ohio-licensed Asbestos Hazard Abatement Contractor.

LIMITATIONS

DET used reasonable efforts to inspect all areas of the building; however, DET cannot guarantee that additional suspect ACM will not be encountered during demolition activities. Any suspect ACM discovered during the course of demolition should be assumed to be ACM unless confirmed otherwise by an Ohio-certified Asbestos Hazard Evaluation Specialist.

This assessment excludes all subsurface materials and/or utilities.

The results and findings of this report are based on PLM bulk analysis only. Currently, federal and state regulations only require the use of PLM bulk analysis for compliance purposes; however, due to limitations of this analytical method to detect small fiber sizes and fibers obscured by cellulose and organic material, the EPA recommends transmission electron microscopy (TEM) confirmation for all organically bound non-friable material and cellulose containing ceiling tile samples found not to contain asbestos using PLM bulk analysis. Please notify DET within 30 days from the date of this report if you would like TEM confirmation for any samples.

We appreciate the opportunity to provide this service to you. Please do not hesitate to contact me if you have any questions regarding this report, or if we can be of further assistance.

Respectfully,

Dayton Environmental Testing, LLC



Michael B. Lee, CIEC
Senior Project Manager
Ohio Asbestos Hazard Evaluation Specialist # ES34954



Kenneth R. Lee
Project Manager
Ohio-Certified Asbestos Hazard Evaluation Specialist # ES35910

ATTACHMENTS

- A - Asbestos Inspection and Assessment Summary
- B - Asbestos Bulk Sampling Log
- C – Site Location Plan and Floor Plan Sketch
- D - Laboratory Analytical Report
- E - Photographs
- F - Qualifications of Assessors
- G - Laboratory's NVLAP Certificate

ATTACHMENT A

ASBESTOS INSPECTION AND ASSESSMENT SUMMARY

Asbestos Inspection and Assessment Summary

City of Dayton - Miami Water Treatment Plant - Administration and Laboratory Building

3210 Chuck Wagner Lane, Dayton, Ohio 45414

Project Number: 25-296-0730

HA ID #	Material	Description	Locations of Material	*Friable or Non-Friable	*NESHAP Category	Sample Numbers Collected	Photo #	Laboratory Results	Asbestos Determination	*Estimated Quantity
1	Drywall & Joint Compound	White with off white paper Drywall Board with White Joint Compound	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-1-1 MAL-1-2 MAL-1-3 MAL-1-4 MAL-1-5 MAL-1-6 MAL-1-7 MAL-1-8 MAL-1-9	1	No Asbestos Detected	Non-ACM	Not Applicable
2	Cove Base & Mastic	6" Tan Vinyl Cove Base & Yellow Mastic	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-2-1 MAL-2-2	2	No Asbestos Detected	Non-ACM	Not Applicable
3	Floor Tile & Mastic	12" Vinyl Composition Tile with green & tan streaks and Black Mastic	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-3-1 MAL-3-2	3	No Asbestos Detected	Non-ACM	Not Applicable
4	Vinyl Plank Flooring	Wood look Vinyl Plank Flooring System (Note: Residual Carpet Adhesive HA ID 25 was Present Underneath in Some Areas)	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-4-1 MAL-4-2	4	No Asbestos Detected	Non-ACM	Not Applicable
5	Adhesive	Yellow Carpet Adhesive	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-5-1 MAL-5-2	5	No Asbestos Detected	Non-ACM	Not Applicable
6	Ceiling Tile	2' x 4' Suspended Acoustical Ceiling Tile, White/Gray w/ small fissures, small holes & dots	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-6-1 MAL-6-2	6	No Asbestos Detected	Non-ACM	Not Applicable
7	Countertop	Black Laboratory Countertop	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-7-1 MAL-7-2	7	No Asbestos Detected	Non-ACM	Not Applicable
8	Grout	4" Ceramic Wall Tile Grout, Off White (Note: Related Mastic is HA ID 41)	Walls of the Men's and Women's Shower Rooms	Not Applicable	Not Applicable	MAL-8-1 MAL-8-2	8	No Asbestos Detected	Non-ACM	Not Applicable
9	Grout & Mortar	1" Ceramic Floor Tile Grout & Mortar, Light Gray	Floors of the Men's and Women's Shower Rooms	Not Applicable	Not Applicable	MAL-9-1 MAL-9-2	9	No Asbestos Detected	Non-ACM	Not Applicable

Asbestos Inspection and Assessment Summary

City of Dayton - Miami Water Treatment Plant - Administration and Laboratory Building

3210 Chuck Wagner Lane, Dayton, Ohio 45414

Project Number: 25-296-0730

HA ID #	Material	Description	Locations of Material	*Friable or Non-Friable	*NESHAP Category	Sample Numbers Collected	Photo #	Laboratory Results	Asbestos Determination	*Estimated Quantity
10	Caulk	White, Pliable Bathroom Caulking	Men's and Women's Restrooms on Sinks and Countertops	Not Applicable	Not Applicable	MAL-10-1 MAL-10-2	10	No Asbestos Detected	Non-ACM	Not Applicable
11	Caulk	Gray, Pliable Associated with Exterior Doors	Throughout Building	Not Applicable	Not Applicable	MAL-11-1 MAL-11-2	11	No Asbestos Detected	Non-ACM	Not Applicable
12	Gasket	7" Pipe Flange Gasket, Black & Brown	Various Locations in Basement	Not Applicable	Not Applicable	MAL-12-1 MAL-12-2	12	No Asbestos Detected	Non-ACM	Not Applicable
13	Gasket	7" Pipe Flange , Red	Various Locations in Basement	Not Applicable	Not Applicable	MAL-13-1 MAL-13-2	13	No Asbestos Detected	Non-ACM	Not Applicable
14	Gasket	7" Pipe Flange , Black	Various Locations in Basement	Not Applicable	Not Applicable	MAL-14-1 MAL-14-2	14	No Asbestos Detected	Non-ACM	Not Applicable
15	Sealer	White Elastomeric Vapor Sealing Pipe Insulation Mastic	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-15-1 MAL-15-2	15	No Asbestos Detected	Non-ACM	Not Applicable
16	Grout & Mortar	6' Gray Quarry Tile Grout & Mortar, Gray	Various Labs Throughout Building	Not Applicable	Not Applicable	MAL-16-1 MAL-16-2	16	No Asbestos Detected	Non-ACM	Not Applicable
17	Sheet Flooring & Mastic	Off White & Tan Sheet Flooring and Tan Mastic	Room 125	Not Applicable	Not Applicable	MAL-17-1 MAL-17-2	17	No Asbestos Detected	Non-ACM	Not Applicable
18	Floor Tile & Mastic	12" Blue Vinyl Composition Tile with Maroon 12" Accent Tiles, both with Black Mastic	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-18-1 MAL-18-2	18	No Asbestos Detected	Non-ACM	Not Applicable
19	Plank Flooring, Floor Tile & Mastic	Top Layer Wood Look Vinyl Plank Flooring with 12" Brown and 12" Beige Floor Tile Beneath & Associated Mastics	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-19-1 MAL-19-2	19	No Asbestos Detected	Non-ACM	Not Applicable
20	Cove Base & Mastic	4" Brown Vinyl Cove Base & Tan Mastic	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-20-1 MAL-20-2	20	No Asbestos Detected	Non-ACM	Not Applicable
21	Cove Base & Mastic	4" Gray Vinyl Cove Base & Tan Mastic	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-21-1 MAL-21-2	21	No Asbestos Detected	Non-ACM	Not Applicable
22	Cove Base & Mastic	4" Tan Vinyl Cove Base & Tan Mastic	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-22-1 MAL-22-2	22	No Asbestos Detected	Non-ACM	Not Applicable

Asbestos Inspection and Assessment Summary

City of Dayton - Miami Water Treatment Plant - Administration and Laboratory Building

3210 Chuck Wagner Lane, Dayton, Ohio 45414

Project Number: 25-296-0730

HA ID #	Material	Description	Locations of Material	*Friable or Non-Friable	*NESHAP Category	Sample Numbers Collected	Photo #	Laboratory Results	Asbestos Determination	*Estimated Quantity
23	Cove Base & Mastic	4" Black Vinyl Cove Base & Tan Mastic	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-23-1 MAL-23-2	23	No Asbestos Detected	Non-ACM	Not Applicable
24	Caulk	Black Window Caulking	Windows Throughout Building	Not Applicable	Not Applicable	MAL-24-1 MAL-24-2	24	No Asbestos Detected	Non-ACM	Not Applicable
25	Carpet Adhesives	Newer and Older Yellow Carpet Adhesive Layers	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-25-1 MAL-25-2	25	No Asbestos Detected	Non-ACM	Not Applicable
26	Insulation	Yellow, Fibrous Insulation	Stairwells	Not Applicable	Not Applicable	MAL-26-1 MAL-26-2 MAL-26-3	26	No Asbestos Detected	Non-ACM	Not Applicable
27	Caulk	White Interior Caulk	Various Interior Door Frames Throughout Building	Not Applicable	Not Applicable	MAL-27-1 MAL-27-2	27	No Asbestos Detected	Non-ACM	Not Applicable
28	Caulk	Gray, Pliable, Interior Caulk	Interior Caulking Associated with Exterior Door Frames	Not Applicable	Not Applicable	MAL-28-1 MAL-28-2	28	No Asbestos Detected	Non-ACM	Not Applicable
29	Caulk	White, Pliable, Exterior Caulk	Exterior Wall Panels	Not Applicable	Not Applicable	MAL-29-1 MAL-29-2	29	No Asbestos Detected	Non-ACM	Not Applicable
30	Caulk	Exterior Caulks, Black & White Mix	Exterior Walls Around Aluminum Band	Not Applicable	Not Applicable	MAL-30-1 MAL-30-2	30	No Asbestos Detected	Non-ACM	Not Applicable
31	Waterproofing	Black, Peeling Tar Type Waterproofing Material	Exterior Foundation	Not Applicable	Not Applicable	MAL-31-1 MAL-31-2	31	No Asbestos Detected	Non-ACM	Not Applicable
32	Seam Filler	Black, Peeling Tar Type Seam Filler Material Associated with Laboratory Counters	Various Locations Throughout Building	Not Applicable	Not Applicable	MAL-32-1 MAL-32-2	32	No Asbestos Detected	Non-ACM	Not Applicable
33	Gaskets	7 Inch and 9 Inch Gaskets	Various Locations Throughout Building	Assumed Non-Friable	Category I Non-Friable	No Samples	33	Not Applicable	Assumed ACM	30 Square Feet
34	Door components	Insulation, Glazing Compound, Gaskets, etc. Associated with Various Doors Throughout the Building	Throughout Building	Assumed Non-Friable	Assumed Category II Non-Friable	No Samples	34	Not Applicable	Assumed ACM	1,260 Square Feet or 60 Doors

Asbestos Inspection and Assessment Summary

City of Dayton - Miami Water Treatment Plant - Administration and Laboratory Building

3210 Chuck Wagner Lane, Dayton, Ohio 45414

Project Number: 25-296-0730

HA ID #	Material	Description	Locations of Material	*Friable or Non-Friable	*NESHAP Category	Sample Numbers Collected	Photo #	Laboratory Results	Asbestos Determination	*Estimated Quantity
35	Cabinet Door and Drawer Front Insulation	Insulation is Assumed to Exist within the Cabinet Doors and Drawer Fronts	Various Locations Throughout Building	Assumed Non-Friable	Assumed Category II Non-Friable	No Samples	35	Not Applicable	Assumed ACM	700 Square Feet
36	Elevator Door Insulation	Insulation Inside Elevator Cab and Hoistway Doors	Elevator	Assumed Non-Friable	Assumed Category II Non-Friable	No Samples	36	Not Applicable	Assumed ACM	100 Square Feet
37	Roofing Materials	Various Roofing Materials (Including but not Limited to Built-Up Roofing, Light-Weight Concrete, Flashing Tars, Sealants, Coatings, etc.)	Entire Roof, Roof Curbs, Parapet Walls, Flashings, etc.)	Assumed Non-Friable	Assumed Category I Non-Friable	No Samples	37	Not Applicable	Assumed ACM	9,000 Square Feet
38	Internal Boiler Components	Internal Boiler Components (Including but not limited to Gaskets, Insulation, Chinking, etc.)	Basement Mechanical Room	Assumed Non-Friable	Assumed Category II Non-Friable	No Samples	38	Not Applicable	Assumed ACM	2 Boiler Units
39	Electrical Systems Components	Various Electrical Systems Components (Including but not Limited to Panels, Boxes, Switchgear, Cabling, Wiring, etc.)	Throughout Building	Assumed Non-Friable	Assumed Category II Non-Friable	No Samples	39	Not Applicable	Assumed ACM	50 Square Feet
40	Mastic Associated with Laboratory Countertops, Backsplashes, and Drying Racks	Mastic is Assumed to Exist Under the Laboratory Countertops, Back Splashes, and Drying Racks	Various Locations Throughout Building	Assumed Non-Friable	Assumed Category II Non-Friable	No Samples	40	Not Applicable	Assumed ACM	1,500 Square Feet
41	Mastic	Tan Mastic Associated with 4" Ceramic Wall Tile (Note: Related Grout is HA ID 8)	Walls of the Men's and Women's Shower Rooms	Not Applicable	Not Applicable	MAL-41-1 MAL-41-2	41	No Asbestos Detected	Non-ACM	Not Applicable

Asbestos Inspection and Assessment Summary

City of Dayton - Miami Water Treatment Plant - Administration and Laboratory Building

3210 Chuck Wagner Lane, Dayton, Ohio 45414

Project Number: 25-296-0730

HA ID #	Material	Description	Locations of Material	*Friable or Non-Friable	*NESHAP Category	Sample Numbers Collected	Photo #	Laboratory Results	Asbestos Determination	*Estimated Quantity
42	Flexible HVAC Duct Connector Cloth	Various Types of HVAC Duct Connector Cloth	Various Locations Throughout Building	Assumed Non-Friable	Assumed Category II Non-Friable	No Samples	42	Not Applicable	Assumed ACM	50 Square Feet

*This assessment is based on overall condition at the time of DET's site visit, and is subject to change based on condition of ACM at the time of abatement or demolition, as well as, the techniques that will be utilized during these activities. The building owner and demolition contractor are ultimately responsible to ensure that an Ohio-certified Asbestos Hazard Evaluation Specialist assesses the condition, friability, and category of Confirmed and Assumed ACM prior to the start of abatement and demolition. All quantities listed in this table are estimates only. Additional quantities may exist. The demolition contractor is responsible to field verify the friability, quantity, and NESHAP category of all ACMs prior to submitting any bids. DET does not guarantee the friability or NESHAP Category of Assumed ACMs.

ATTACHMENT B
ASBESTOS BULK SAMPLING LOG

Sample #	Group #	Collection Date	Material	Color/Description	Sample Location	Collected By
MAL1-1		8/18/2025	Drywall & Joint Compound	White with off white paper	Room 130 NW wall corner	Ken Lee ES35910
MAL1-2		8/18/2025	Drywall & Joint Compound	White with off white paper	Room 132 west wall by doors to stairwell	Ken Lee ES35910
MAL 1-3		8/18/2025	Drywall & Joint Compound	White with off white paper	Men's rest room corner by entry door	Ken Lee ES35910
MAL 1-4		8/18/2025	Drywall & Joint Compound	White with off white paper	Room 125 closet wall	Ken Lee ES35910
MAL 1-5		8/18/2025	Drywall & Joint Compound	White with off white paper	Room 104 break room corner by door	Ken Lee ES35910
MAL 1-6		8/18/2025	Drywall & Joint Compound	White with off white paper	Room 113 conference room NE corner	Ken Lee ES35910
MAL 1-7		8/18/2025	Drywall & Joint Compound	White with off white paper	Basement elevator lobby at corner by stairwell door	Ken Lee ES35910
MAL 1-8		8/18/2025	Drywall & Joint Compound	White with off white paper	Basement storage room 109 corner by door	Ken Lee ES35910
MAL 1-9		8/18/2025	Drywall & Joint Compound	White with off white paper	Stairwell basement landing, corner wall by door	Ken Lee ES35910
MAL 2-1		8/18/2025	Cove Base & Mastic	6" Tan Vinyl Cove Base & Yellow Mastic	Room 117 by door	Ken Lee ES35910
MAL 2-2		8/18/2025	Cove Base & Mastic	6" Tan Vinyl Cove Base & Yellow Mastic	Room 117 corner by door	Ken Lee ES35910
MAL 3-1		8/18/2025	Floor Tile & Mastic	12" Vinyl Composition Tile with green & tan streaks and Black Mastic	Middle of stairwell hall	Ken Lee ES35910
MAL 3-2		8/18/2025	Floor Tile & Mastic	12" Vinyl Composition Tile with green & tan streaks and Black Mastic	Room 132 NW corner	Ken Lee ES35910
MAL 4-1		8/18/2025	Plank Flooring & Mastic	Wood look Vinyl Plank Flooring System & Associated Mastics	Reception lobby outside room 138 conference room, beneath the coat rack	Ken Lee ES35910
MAL 4-2		8/18/2025	Plank Flooring & Mastic	Wood look Vinyl Plank Flooring System & Associated Mastics	Reception lobby outside room 138 conference room, beneath the coat rack	Ken Lee ES35910
MAL 5-1		8/18/2025	Adhesive	Yellow Carpet Adhesive	Room114 corner by door	Ken Lee ES35910
MAL 5-2		8/18/2025	Adhesive	Yellow Carpet Adhesive	Room 135 corner by door	Ken Lee ES35910
MAL 6-1		8/18/2025	Ceiling Tile	2' x 4' Suspended Acoustical Ceiling Tile, White/Gray w/ small fissures, small holes & dots	Stairwell, middle north side	Ken Lee ES35910

Sample #	Group #	Collection Date	Material	Color/Description	Sample Location	Collected By
MAL6-2		8/18/2025	Ceiling Tile	2' x 4' Suspended Acoustical Ceiling Tile, White/Gray w/ small fissures, small holes & dots	Room 113, conference room, SE corner	Ken Lee ES35910
MAL7-1		8/18/2025	Countertop	Black Laboratory Countertop	Room 103 side of countertop	Ken Lee ES35910
MAL7-2		8/18/2025	Countertop	Black Laboratory Countertop	Room 122 side of countertop	Ken Lee ES35910
MAL8-1		8/19/2025	Grout	4" Ceramic Wall Tile Grout, Off White	Men's rest room shower area wall behind door	Ken Lee ES35910
MAL8-2		8/19/2025	Grout	4" Ceramic Wall Tile Grout, Off White	Women's rest room shower area wall behind door	Ken Lee ES35910
MAL9-1		8/19/2025	Grout & Mortar	1" Ceramic Floor Tile Grout & Mortar, Light Gray	Men's rest room shower area floor behind door	Ken Lee ES35910
MAL9-2		8/19/2025	Grout & Mortar	1" Ceramic Floor Tile Grout & Mortar, Light Gray	Women's rest room shower area floor behind door	Ken Lee ES35910
MAL10-1		8/19/2025	Caulk	White, Pliable	Men's rest room sink	Ken Lee ES35910
MAL10-2		8/19/2025	Caulk	White, Pliable	Women's rest room sink	Ken Lee ES35910
MAL11-1		8/19/2025	Caulk	Gray, Pliable	Exterior side of metal door frame located at the most NW entrance door	Ken Lee ES35910
MAL11-2		8/19/2025	Caulk	Gray, Pliable	Exterior side of metal door frame at SW basement entrance door, located at bottom of outside stairs	Ken Lee ES35910
MAL12-1		8/19/2025	Gasket	7" Pipe Flange Gasket, Black & Brown	Basement cold water line	Ken Lee ES35910
MAL12-2		8/19/2025	Gasket	7" Pipe Flange Gasket, Black & Brown	Basement cold water line	Ken Lee ES35910
MAL13-1		8/19/2025	Gasket	7" Pipe Flange , Red	Basement cold water line	Ken Lee ES35910
MAL13-2		8/19/2025	Gasket	7" Pipe Flange , Red	Basement cold water line	Ken Lee ES35910
MAL14-1		8/19/2025	Gasket	7" Pipe Flange , Black	Basement cold water line close to water meter	Ken Lee ES35910
MAL14-2		8/19/2025	Gasket	7" Pipe Flange , Black	Basement cold water line close to water meter	Ken Lee ES35910
MAL15-1		8/19/2025	Sealer	White Elastomeric Vapor Sealing Pipe Insulation Mastic	Boiler room pipe insulation end coating	Ken Lee ES35910

Sample #	Group #	Collection Date	Material	Color/Description	Sample Location	Collected By
MAL15-2		8/19/2025	Sealer	White Elastomeric Vapor Sealing Pipe Insulation Mastic	Boiler room pipe insulation end coating by door	Ken Lee ES35910
MAL16-1		8/19/2025	Grout & Mortar	6' Gray Quarry Tile Grout & Mortar, Gray	Room 103, center room below a desk area trash can	Ken Lee ES35910
MAL16-2		8/19/2025	Grout & Mortar	6" Gray Quarry Tile Grout & Mortar, Gray	Room 122, floor by north door to corridor	Ken Lee ES35910
MAL17-1		8/19/2025	Sheet Flooring & Mastic	Off White & Tan Sheet Flooring and Tan Mastic	Room 125 closet floor	Ken Lee ES35910
MAL17-2		8/19/2025	Sheet Flooring & Mastic	Off White & Tan Sheet Flooring and Tan Mastic	Room 125 beside entry door	Ken Lee ES35910
MAL18-1		8/19/2025	Floor Tile & Mastic	12" Blue Vinyl Composition Tile with Maroon 12" Accent Tiles, both with Black Mastic	Room 104 break room by door, under floor mat	Ken Lee ES35910
MAL18-2		8/19/2025	Floor Tile & Mastic	12" Blue Vinyl Composition Tile with Maroon 12" Accent Tiles, both with Black Mastic	Room 104 in corner beneath recycle containers	Ken Lee ES35910
MAL19-1		8/19/2025	Plank Flooring, Floor Tile & Mastic	Top Layer Wood Look Vinyl Plank Flooring with Floor Tile Beneath & Associated Mastics	Lab corridor, west end beneath potted plant	Ken Lee ES35910
MAL19-2		8/19/2025	Plank Flooring, Floor Tile & Mastic	Top Layer Wood Look Vinyl Plank Flooring with Floor Tile Beneath & Associated Mastics	Room 132 entry hall off laboratory corridor	Ken Lee ES35910
MAL20-1		8/19/2025	Cove Base & Mastic	4" Brown Vinyl Cove Base & Tan Mastic	Room 132 entry hall by door	Ken Lee ES35910
MAL20-2		8/19/2025	Cove Base & Mastic	4" Brown Vinyl Cove Base & Tan Mastic	Outside of Room 117 entry door	Ken Lee ES35910
MAL21-1		8/19/2025	Cove Base & Mastic	4" Gray Vinyl Cove Base & Tan Mastic	Room 114 corner by door	Ken Lee ES35910
MAL21-2		8/19/2025	Cove Base & Mastic	4" Gray Vinyl Cover Base & Mastic	Room 137 by door	Ken Lee ES35910
MAL22-1		8/19/2025	Cove Base & Mastic	4" Tan Vinyl Cove Base & Tan Mastic	Women's rest room by door	Ken Lee ES35910
MAL22-2		8/19/2025	Cove Base & Mastic	4" Tan Vinyl Cove Base & Tan Mastic	Room 125 closet	Ken Lee ES35910
MAL23-1		8/19/2025	Cove Base & Mastic	4" Black Vinyl Cove Base & Tan Mastic	Room 120 by north door to corridor	Ken Lee ES35910
MAL23-2		8/19/2025	Cove Base & Mastic	4" Black Vinyl Cove Base & Tan Mastic	Room 122 laboratory cabinet base	Ken Lee ES35910
MAL24-1		8/19/2025	Caulk	Black Interior Side Window Caulk (between glass & window frame)	Room 122 cabinet base	Ken Lee ES35910

Sample #	Group #	Collection Date	Material	Color/Description	Sample Location	Collected By
MAL24-2		8/19/2025	Caulk	Black Interior Side Window Caulk (between glass & window frame)	Conference room hallway window	Ken Lee ES35910
MAL25-1		8/19/2025	Carpet Adhesives	Newer and Older Yellow Carpet Adhesive Layers	Room 117 by door	Ken Lee ES35910
MAL25-2		8/19/2025	Carpet Adhesives	Newer and Older Yellow Carpet Adhesive Layers	Room 117 by door	Ken Lee ES35910
MAL26-1		8/19/2025	Insulation	Yellow, Fibrous	Stairwell hall between roof decking & bar joist NE	Ken Lee ES35910
MAL26-2		8/19/2025	Insulation	Yellow, Fibrous	Stairwell hall between roof decking & bar joist NW	Ken Lee ES35910
MAL26-3		8/19/2025	Insulation	Yellow, Fibrous	Stairwell I-Beam below roof decking on west elevation	Ken Lee ES35910
MAL27-1		8/19/2025	Caulk	White Interior Caulk	Room 125 door frame into the stairwell hall	Ken Lee ES35910
MAL27-2		8/19/2025	Caulk	White Interior Caulk	1st floor elevator door frame	Ken Lee ES35910
MAL28-1		8/19/2025	Caulk	Gray, Pliable, Interior Caulk	Interior side of door frame to the outside, located in the stairwell hall	Ken Lee ES35910
MAL28-2		8/19/2025	Caulk	Gray, Pliable, Interior Caulk	Interior side of door frame from the room 125 staging area to the outside canopy loading dock	Ken Lee ES35910
MAL29-1		8/19/2025	Caulk	White, Pliable, Exterior Caulk	Exterior east end wall 1" caulk between wall panels	Ken Lee ES35910
MAL29-2		8/19/2025	Caulk	White, Pliable, Exterior Caulk	Exterior west end wall 1" caulk between wall panels	Ken Lee ES35910
MAL30-1		8/19/2025	Caulks	Exterior Caulks, Black & White Mix	East end fiberglass wall at surrounding aluminum band	Ken Lee ES35910
MAL30-2		8/19/2025	Caulks	Exterior Caulks, Black & White Mix	West end fiberglass wall at surrounding aluminum band	Ken Lee ES35910
MAL31-1		8/19/2025	Waterproofing	Black, Peeling Tar Type Waterproofing Material	West exterior concrete foundation	Ken Lee ES35910
MAL31-2		8/19/2025	Waterproofing	Black, Peeling Tar Type Waterproofing Material	North exterior concrete foundation	Ken Lee ES35910
MAL32-1		8/21/2025	Seam Filler	Black, Peeling Tar Type Seam Filler Material	Room 122 west side of the east laboratory countertop seam	Ken Lee ES35910
MAL32-2		8/21/2025	Seam Filler	Black, Peeling Tar Type Seam Filler Material	Room 122 side of the east laboratory countertop seam	Ken Lee ES35910

Asbestos Bulk Sampling Log

City of Dayton - Miami Water Treatment Plant - Administration and Laboratory Building
3210 Chuck Wagner Lane, Dayton, Ohio 45414
Project Number: 25-296-0730

Sample #	Group #	Collection Date	Material	Color/Description	Sample Location	Collected By
MAL-41-1		9/2/2025	Mastic	Tan Mastic Associated with 4" Ceramic Wall Tile	Men's Restroom, East Shower Room Wall	Ken Lee ES35910
MAL-41-2		9/2/2025	Mastic	Tan Mastic Associated with 4" Ceramic Wall Tile	Women's Restroom, West Shower Wall	Ken Lee ES35910

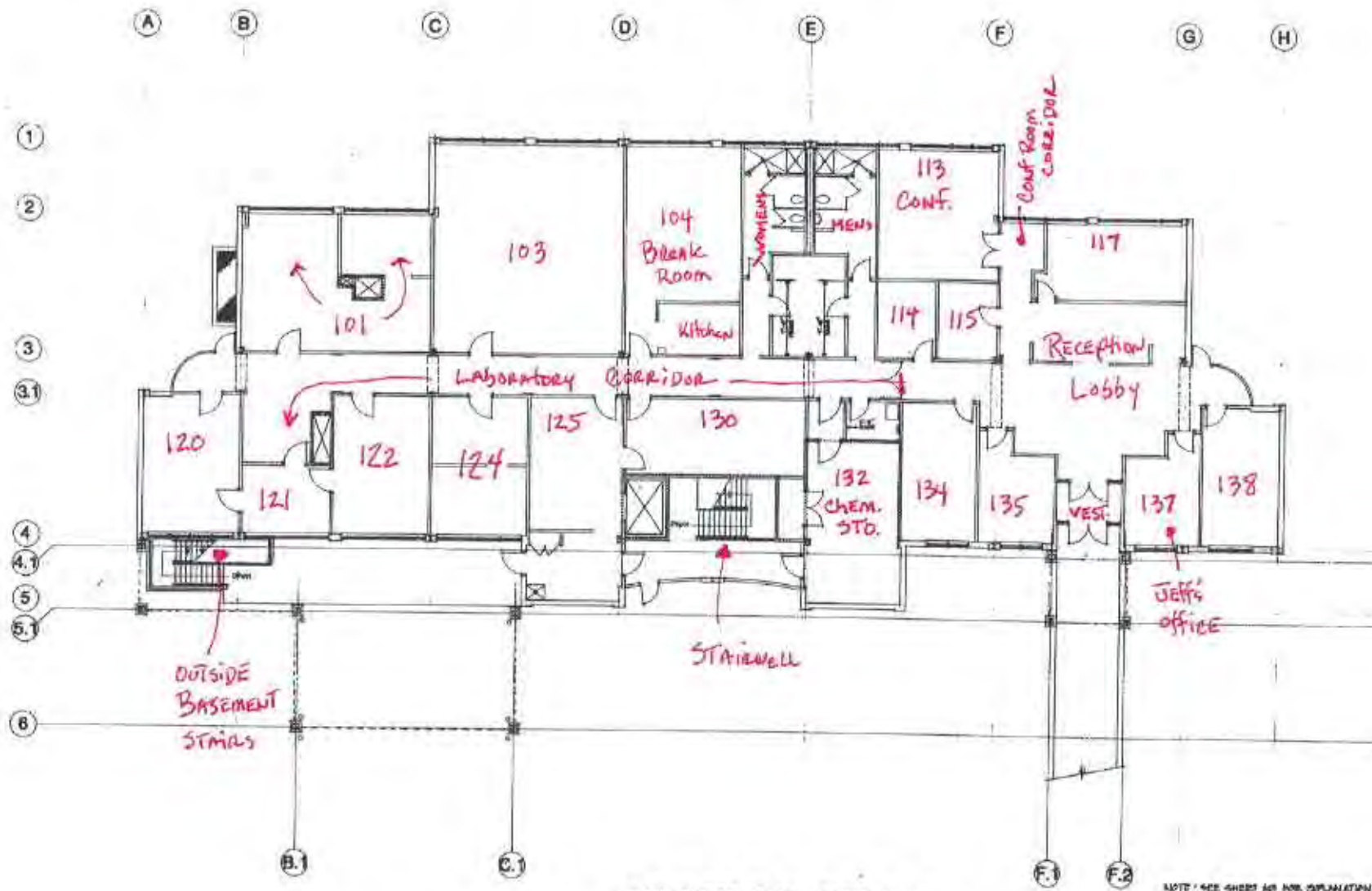
ATTACHMENT C
SITE LOCATION PLAN AND FLOOR PLAN SKETCH



Note: This pre-renovation asbestos survey is strictly limited to the Administration and Laboratory Building. All other areas buildings are excluded from this survey.

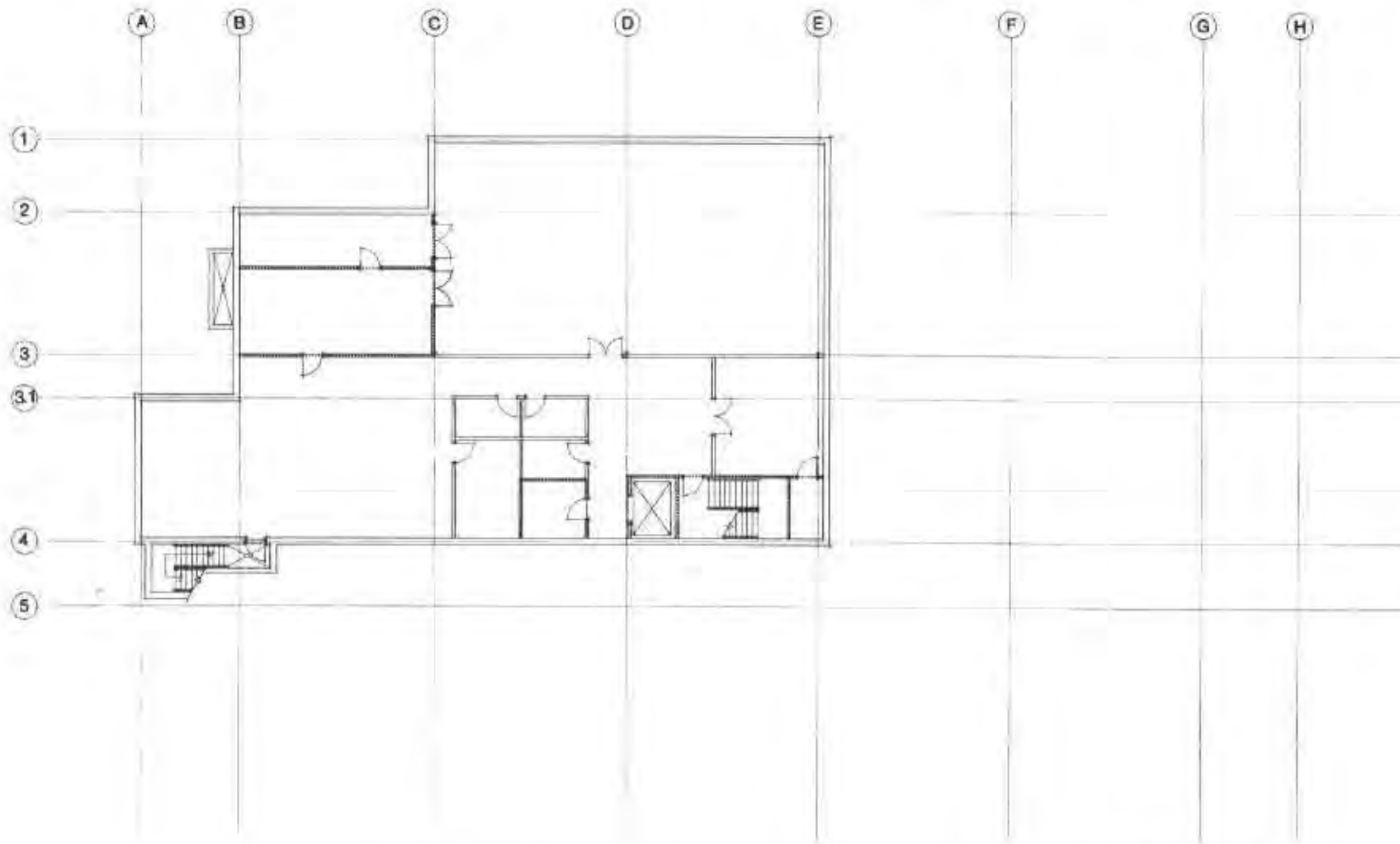


Site Location Plan		
Maimi Treatment Plant - Administration and Laboratory Building		
3210 Chuck Wagner Lane, Dayton, Ohio 45414		
Sampling Date(s): August 18, 2025 to August 20, 2025		
Project #: 25-296-0730		PAGE 1 OF 1
	2750-B Indian Ripple Road, Suite 211 Dayton, Ohio 45459 (937) 751-7872 www.daytontesting.com	



FIRST FLOOR PLAN - RATED WALLS
 SCALE: 1/8" = 1'-0"

NOTE: SEE SHEET 401 FOR EXPLANATION OF
 SYMBOLS AND DETAILED WALL TYPES.
 SEE SHEET 401 FOR DETAILS ON WALL TYPES.



BASEMENT FLOOR PLAN - RATED WALLS
 SCALE: 1/8" = 1'-0"

NOTE: SEE SHEET A-1 FOR EXPLANATION OF
 SYMBOLS & DETAILS. WALL TYPES
 ARE SHOWN AS PER DETAILS ON WALL TYPES.

ATTACHMENT D
LABORATORY ANALYTICAL REPORT



Analysis Report

Schneider Laboratories Global, Inc

2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • Fax 804-359-1475

Customer: Dayton Environmental Testing, LLC (4738)
Address: 2750-B Indian Ripple Rd
Suite 211
Dayton, OH 45440

Order #: 641906

Received 08/22/25
Analyzed 08/27/25
Reported 08/29/25

Attn:

Project: Miami Water Treat Plant-Admin
Location: 3210 Chuck Wagner Lane, Dayton
Number: 25-296-0730.3

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
641906-001	08/18/25	MAL1-1	Room 130 NW Wall Corner		
Layer 1:	Drywall			No Asbestos Detected	8% CELLULOSE FIBER
	White/Off White, Powdery				92% NON FIBROUS MATERIAL
Layer 2:	Joint Compound			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Granular				
641906-002	08/18/25	MAL1-2	Room 132 W Wall By Doors		
Layer 1:	Drywall			No Asbestos Detected	8% CELLULOSE FIBER
	White/Off White, Powdery				92% NON FIBROUS MATERIAL
Layer 2:	Joint Compound			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Granular				
641906-003	08/18/25	MAL1-3	Men's Rest Room Corner		
Layer 1:	Drywall			No Asbestos Detected	8% CELLULOSE FIBER
	White/Off White, Powdery				92% NON FIBROUS MATERIAL
Layer 2:	Joint Compound			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Granular				
641906-004	08/18/25	MAL1-4	Room 125 Closet		
Layer 1:	Drywall			No Asbestos Detected	8% CELLULOSE FIBER
	White/Off White, Powdery				92% NON FIBROUS MATERIAL
Layer 2:	Joint Compound			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Granular				

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. The test results apply to the sample as received.

Project: Miami Water Treat Plant-Admin
Location: 3210 Chuck Wagner Lane, Dayton
Number: 25-296-0730.3

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
641906-005	08/18/25	MAL1-5	Room 104 Break Room		
Layer 1:	Drywall			No Asbestos Detected	8% CELLULOSE FIBER
	White/Off White, Powdery				92% NON FIBROUS MATERIAL
Layer 2:	Joint Compound			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Granular				
641906-006	08/18/25	MAL1-6	Room 113 Conference Room		
Layer 1:	Drywall			No Asbestos Detected	8% CELLULOSE FIBER
	White/Off White, Powdery				92% NON FIBROUS MATERIAL
Layer 2:	Joint Compound			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Granular				
641906-007	08/18/25	MAL1-7	Basement Elevator Lobby		
Layer 1:	Drywall			No Asbestos Detected	8% CELLULOSE FIBER
	White/Off White, Powdery				92% NON FIBROUS MATERIAL
Layer 2:	Joint Compound			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Granular				
641906-008	08/18/25	MAL1-8	Basement Storage Room 109		
Layer 1:	Drywall			No Asbestos Detected	8% CELLULOSE FIBER
	White/Off White, Powdery				92% NON FIBROUS MATERIAL
Layer 2:	Joint Compound			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Granular				
641906-009	08/18/25	MAL1-9	Stairwell Basement Land		
Layer 1:	Drywall			No Asbestos Detected	8% CELLULOSE FIBER
	White/Off White, Powdery				92% NON FIBROUS MATERIAL
Layer 2:	Joint Compound			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Granular				

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Project: Miami Water Treat Plant-Admin
Location: 3210 Chuck Wagner Lane, Dayton
Number: 25-296-0730.3

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
641906-010	08/18/25	MAL2-1	Room 117 by Door		
Layer 1:	Cove Base Tan, Rubbery			No Asbestos Detected	100% NON FIBROUS MATERIAL
Layer 2:	Mastic Yellow, Soft			No Asbestos Detected	100% NON FIBROUS MATERIAL
641906-011	08/18/25	MAL2-2	Room 117 Corner by Door		
Layer 1:	Cove Base Tan, Rubbery			No Asbestos Detected	100% NON FIBROUS MATERIAL
Layer 2:	Mastic Yellow, Soft			No Asbestos Detected	100% NON FIBROUS MATERIAL
641906-012	08/18/25	MAL3-1	Middle Stairwell Hallway		
Layer 1:	Floor Tile Green/Tan, Organically Bound			No Asbestos Detected	100% NON FIBROUS MATERIAL
Layer 2:	Mastic Black, Bituminous			No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
641906-013	08/18/25	MAL3-2	Room 132 NE Corner		
Layer 1:	Floor Tile Green/Tan, Organically Bound			No Asbestos Detected	100% NON FIBROUS MATERIAL
Layer 2:	Mastic Black, Bituminous			No Asbestos Detected	2% CELLULOSE FIBER 98% NON FIBROUS MATERIAL
641906-014	08/18/25	MAL4-1	Reception Lobby Out 138		
Layer 1:	Flooring Brown, Organically Bound No mastic found.			No Asbestos Detected	100% NON FIBROUS MATERIAL
Layer 2:	Soft Material White, Soft			No Asbestos Detected	90% NON FIBROUS MATERIAL 10% SYNTHETIC FIBER

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Project: Miami Water Treat Plant-Admin
Location: 3210 Chuck Wagner Lane, Dayton
Number: 25-296-0730.3

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
641906-015	08/18/25	MAL4-2	Reception Lobby Out Conf		
Layer 1:	Floor Tile			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Brown, Organically Bound				
Layer 2:	Mastic			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Yellow, Brittle				
Layer 3:	Soft Material			No Asbestos Detected	85% NON FIBROUS MATERIAL
	White, Soft				15% SYNTHETIC FIBER
641906-016	08/18/25	MAL5-1	Room 114 Corner by Door		
Layer 1:	Adhesive			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Yellow, Brittle				
641906-017	08/18/25	MAL5-2	Room 135 Corner by Door		
Layer 1:	Adhesive			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Yellow, Brittle				
641906-018	08/18/25	MAL6-1	Stairwell, Middle N Side		
Layer 1:	Ceiling Tile			No Asbestos Detected	65% CELLULOSE FIBER
	White/Light Gray, Fibrous				15% MINERAL/GLASS WOOL
					20% NON FIBROUS MATERIAL
641906-019	08/18/25	MAL6-2	Room 113 Conference SE		
Layer 1:	Ceiling Tile			No Asbestos Detected	65% CELLULOSE FIBER
	White/Light Gray, Fibrous				15% MINERAL/GLASS WOOL
					20% NON FIBROUS MATERIAL
641906-020	08/18/25	MAL7-1	Room 103 Side Countertop		
Layer 1:	Counter Top			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Black, Brittle				
641906-021	08/18/25	MAL7-2	Room 122 Side Countertop		
Layer 1:	Counter Top			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Black, Brittle				
641906-022	08/18/25	MAL8-1	Men's Rest Shower Wall		
Layer 1:	Grout			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Off White, Hard/Granular				

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Project: Miami Water Treat Plant-Admin
Location: 3210 Chuck Wagner Lane, Dayton
Number: 25-296-0730.3

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
641906-023	08/18/25	MAL8-2	Women's Rest Shower Wall		
Layer 1:	Grout			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Off White, Hard/Granular				
641906-024	08/18/25	MAL9-1	Man's Rest Shower Floor		
Layer 1:	Mortar&Grout			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Light Gray, Granular				
Unable to separate individual layers.					
641906-025	08/18/25	MAL9-2	Women's Rest Shower Floor		
Layer 1:	Mortar&Grout			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Light Gray, Granular				
Unable to separate individual layers.					
641906-026	08/18/25	MAL10-1	Men's Rest Sink		
Layer 1:	Caulk			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Rubbery				
641906-027	08/18/25	MAL10-2	Women's Rest Sink		
Layer 1:	Caulk			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Rubbery				
641906-028	08/18/25	MAL11-1	Ext Metal Door Frame NW		
Layer 1:	Caulk			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Gray, Rubbery				
641906-029	08/18/25	MAL11-2	Ext Metal Door Frame SW		
Layer 1:	Caulk			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Gray, Rubbery				
641906-030	08/18/25	MAL12-1	Basement Cold Water Line		
Layer 1:	Gasket			No Asbestos Detected	15% CELLULOSE FIBER
	Black/Brown, Brittle				85% NON FIBROUS MATERIAL
641906-031	08/18/25	MAL12-2	Basement Cold Water Line		
Layer 1:	Gasket			No Asbestos Detected	20% CELLULOSE FIBER
	Black/Brown, Brittle				80% NON FIBROUS MATERIAL

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Project: Miami Water Treat Plant-Admin
Location: 3210 Chuck Wagner Lane, Dayton
Number: 25-296-0730.3

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
641906-032	08/18/25	MAL13-1	Basement Cold Water Line		
Layer 1:	Gasket			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Red, Rubbery				
641906-033	08/18/25	MAL13-2	Basement Cold Water Line		
Layer 1:	Gasket			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Red, Rubbery				
641906-034	08/18/25	MAL14-1	Basement Cold Water Gauge		
Layer 1:	Gasket			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Black, Rubbery				
641906-035	08/18/25	MAL14-2	Basement Cold Water Gauge		
Layer 1:	Gasket			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Black, Rubbery				
641906-036	08/18/25	MAL15-1	Boiler Room Pipe End		
Layer 1:	Pipe Insulation			No Asbestos Detected	90% MINERAL/GLASS WOOL
	Yellow, Fibrous				10% NON FIBROUS MATERIAL
Layer 2:	Mastic			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Soft				
641906-037	08/18/25	MAL15-2	Boiler Room Pipe End		
Layer 1:	Pipe Insulation			No Asbestos Detected	90% MINERAL/GLASS WOOL
	Yellow, Fibrous				10% NON FIBROUS MATERIAL
Layer 2:	Mastic			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Soft				
641906-038	08/18/25	MAL16-1	Room 102 Center Below		
Layer 1:	Mortar&Grout			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Gray, Granular				
Unable to separate individual layers.					
641906-039	08/18/25	MAL16-2	Room 122 Floor N Door		
Layer 1:	Mortar&Grout			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Gray, Granular				

Unable to separate individual layers.

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. The test results apply to the sample as received.

Project: Miami Water Treat Plant-Admin
Location: 3210 Chuck Wagner Lane, Dayton
Number: 25-296-0730.3

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
641906-040	08/18/25	MAL17-1	Room 125 Closet		
Layer 1:	Sheet Flooring			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Off White/Tan, Organically Bound				
Layer 2:	Mastic			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Tan, Soft				
641906-041	08/18/25	MAL17-2	Room 125 Entry Door		
Layer 1:	Sheet Flooring			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Off White/Tan, Organically Bound				
Layer 2:	Mastic			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Tan, Soft				
641906-042	08/18/25	MAL18-1	Room 104 Break Room		
Layer 1:	Floor Tile			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Blue, Organically Bound				
Layer 2:	Mastics			No Asbestos Detected	2% CELLULOSE FIBER
	Yellow/Black, Brittle/Bituminous				98% NON FIBROUS MATERIAL
Unable to separate individual layers.					
Layer 3:	Floor Tile			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Maroon, Organically Bound				
Layer 4:	Mastics			No Asbestos Detected	5% CELLULOSE FIBER
	Yellow/Black, Brittle/Bituminous				95% NON FIBROUS MATERIAL
Unable to separate individual layers.					

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Project: Miami Water Treat Plant-Admin
Location: 3210 Chuck Wagner Lane, Dayton
Number: 25-296-0730.3

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
641906-043	08/18/25	MAL18-2	Room 104 Beneath Recycle		
Layer 1:	Floor Tile			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Blue, Organically Bound				
Layer 2:	Mastic			No Asbestos Detected	2% CELLULOSE FIBER
	Black, Bituminous				98% NON FIBROUS MATERIAL
	No yellow mastic found.				
Layer 3:	Floor Tile			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Maroon, Organically Bound				
Layer 4:	Mastic			No Asbestos Detected	2% CELLULOSE FIBER
	Black, Bituminous				98% NON FIBROUS MATERIAL
	No yellow mastic found.				
641906-044	08/18/25	MAL19-1	Lab Corridor, W End		
Layer 1:	Floor Tile			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Brown, Organically Bound				
	No mastic found.				
Layer 2:	Floor Tile			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Blue, Organically Bound				
Layer 3:	Mastic			No Asbestos Detected	5% CELLULOSE FIBER
	Black, Bituminous				95% NON FIBROUS MATERIAL
Layer 4:	Floor Tile			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Beige, Organically Bound				
Layer 5:	Mastic			No Asbestos Detected	5% CELLULOSE FIBER
	Black, Bituminous				95% NON FIBROUS MATERIAL

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Project: Miami Water Treat Plant-Admin
Location: 3210 Chuck Wagner Lane, Dayton
Number: 25-296-0730.3

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
641906-045	08/18/25	MAL19-2	Room 132 Entry Hall Lab		
Layer 1:	Floor Tile			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Brown, Organically Bound				
Layer 2:	Floor Tile			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Beige, Organically Bound				
Layer 3:	Mastic			No Asbestos Detected	2% CELLULOSE FIBER
	Black, Bituminous				98% NON FIBROUS MATERIAL
	No blue floor tile found.				
641906-046	08/18/25	MAL20-1	Room 132 Entry Hall Door		
Layer 1:	Cove Base			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Brown, Rubbery				
Layer 2:	Mastic			No Asbestos Detected	4% CELLULOSE FIBER
	Tan, Soft				96% NON FIBROUS MATERIAL
641906-047	08/18/25	MAL20-2	Outside Room 117 Entry		
Layer 1:	Cove Base			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Brown, Rubbery				
Layer 2:	Mastic			No Asbestos Detected	5% CELLULOSE FIBER
	Tan, Soft				95% NON FIBROUS MATERIAL
641906-048	08/18/25	MAL21-1	Room 114 Corner by Door		
Layer 1:	Cove Base			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Gray, Rubbery				
Layer 2:	Mastic			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Tan, Soft				
641906-049	08/18/25	MAL21-2	Room 137 Door		
Layer 1:	Cove Base			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Gray, Rubbery				
Layer 2:	Mastic			No Asbestos Detected	10% CELLULOSE FIBER
	Tan, Soft				90% NON FIBROUS MATERIAL

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Project: Miami Water Treat Plant-Admin
Location: 3210 Chuck Wagner Lane, Dayton
Number: 25-296-0730.3

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
641906-050	08/18/25	MAL22-1	Women's Rest Room Door		
Layer 1:	Cove Base			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Tan, Rubbery				
Layer 2:	Mastic			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Tan, Soft				
641906-051	08/18/25	MAL22-2	Room 125 Closet		
Layer 1:	Cove Base			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Tan, Rubbery				
Layer 2:	Mastic			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Tan, Soft				
641906-052	08/18/25	MAL23-1	Room 120 N Door		
Layer 1:	Cove Base			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Black, Rubbery				
Layer 2:	Mastic			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Tan, Soft				
641906-053	08/18/25	MAL23-2	Room 122 Lab Cabinet		
Layer 1:	Cove Base			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Black, Rubbery				
Layer 2:	Mastic			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Tan, Soft				
641906-054	08/18/25	MAL24-1	Room 117 Middle Window		
Layer 1:	Window Caulk			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Black, Rubbery				
641906-055	08/18/25	MAL24-2	Conf Room Hall Wind		
Layer 1:	Window Caulk			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Black, Rubbery				
641906-056	08/18/25	MAL25-1	Room 117 Door		
Layer 1:	Adhesive			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Yellow, Brittle				

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Location: 3210 Chuck Wagner Lane, Dayton
Number: 25-296-0730.3

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
641906-057	08/18/25	MAL25-2	Room 117 Door		
Layer 1:	Adhesive			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Yellow, Brittle				
641906-058	08/18/25	MAL26-1	Stair Hall Roof Deck NE		
Layer 1:	Insulation			No Asbestos Detected	95% MINERAL/GLASS WOOL
	Yellow, Fibrous				5% NON FIBROUS MATERIAL
641906-059	08/18/25	MAL26-2	Stair Hall Roof Deck NW		
Layer 1:	Insulation			No Asbestos Detected	95% MINERAL/GLASS WOOL
	Yellow, Fibrous				5% NON FIBROUS MATERIAL
641906-060	08/18/25	MAL26-3	Stair I-beam Roof Deck W		
Layer 1:	Insulation			No Asbestos Detected	95% MINERAL/GLASS WOOL
	Yellow, Fibrous				5% NON FIBROUS MATERIAL
641906-061	08/18/25	MAL27-1	Room 125 Door into Stair		
Layer 1:	Caulk			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Rubbery				
641906-062	08/18/25	MAL27-2	1st Floor Elevator Door		
Layer 1:	Caulk			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Rubbery				
641906-063	08/18/25	MAL28-1	Int Door Frame S Hallway		
Layer 1:	Caulk			No Asbestos Detected	100% NON FIBROUS MATERIAL
	Gray, Rubbery				
641906-064	08/18/25	MAL28-2	Int Door Frame Room 125		
Layer 1:	Caulk			No Asbestos Detected	2% CELLULOSE FIBER
	Gray, Rubbery				98% NON FIBROUS MATERIAL
641906-065	08/18/25	MAL29-1	Ext E End Wall		
Layer 1:	Caulk			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Rubbery				
641906-066	08/18/25	MAL29-2	Ext SW Side Canopy		
Layer 1:	Caulk			No Asbestos Detected	100% NON FIBROUS MATERIAL
	White, Rubbery				

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. The test results apply to the sample as received.

Project: Miami Water Treat Plant-Admin
Location: 3210 Chuck Wagner Lane, Dayton
Number: 25-296-0730.3

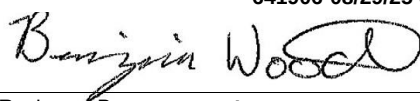
Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
641906-067	08/18/25	MAL30-1	E End Wall		
Layer 1:	Caulk Black, Soft/Bituminous			No Asbestos Detected	100% NON FIBROUS MATERIAL
Layer 2:	Caulk White, Rubbery			No Asbestos Detected	100% NON FIBROUS MATERIAL
641906-068	08/18/25	MAL30-2	W End Wall		
Layer 1:	Caulk Black, Soft/Bituminous			No Asbestos Detected	100% NON FIBROUS MATERIAL
Layer 2:	Caulk White, Rubbery			No Asbestos Detected	100% NON FIBROUS MATERIAL
641906-069	08/18/25	MAL31-1	W Ext Foundation		
Layer 1:	Waterproofing Black, Rubbery/Bituminous			No Asbestos Detected	100% NON FIBROUS MATERIAL
641906-070	08/18/25	MAL31-2	N Ext Foundation		
Layer 1:	Waterproofing Black, Rubbery/Bituminous			No Asbestos Detected	100% NON FIBROUS MATERIAL
641906-071	08/18/25	MAL32-1	Room 122 W Side of E Lab		
Layer 1:	Seam Filler Gray/Black, Brittle			No Asbestos Detected	90% NON FIBROUS MATERIAL 10% WOLLASTONITE
641906-072	08/18/25	MAL32-2	Room 122 E Side of E Lab		
Layer 1:	Seam Filler Gray/Black, Brittle			No Asbestos Detected	90% NON FIBROUS MATERIAL 10% WOLLASTONITE

EPA Regulatory Limit: 1%
Total layers analyzed on order: 114


Analyst **Thoria Nadiem**

641906-08/29/25 04:01 PM

Reviewed By: **Ben Wood**
Laboratory Director

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. The test results apply to the sample as received.

641906

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City of Dayton - Miami Water Treatment Plant - Administration and Laboratory Building

3210 Chuck Wagner Lane, Dayton, Ohio 45414

Project Number: 25-296-0730

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UPS

8/22/2025 9:31:10 AM

1Z2E28998490200639

Testing, LLC

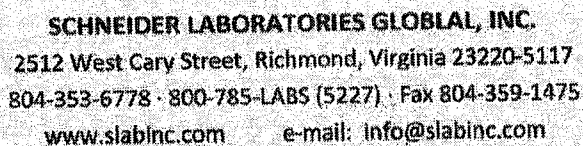
Asbestos Bulk Sampling Log

Sample #	Group #	Collection Date	Material	Color/Description	Sample Location	Collected By
MAL1-1		8/18/2025	Drywall & Joint Compound	White with off white paper	Room 130 NW wall corner	Ken Lee ES35910
MAL1-2		8/18/2025	Drywall & Joint Compound	White with off white paper	Room 132 west wall by doors to stairwell	Ken Lee ES35910
MAL1-3		8/18/2025	Drywall & Joint Compound	White with off white paper	Men's Rest Room corner by entry door	Ken Lee ES35910
MAL1-4		8/18/2025	Drywall & Joint Compound	White with off white paper	Room 125 closet	Ken Lee ES35910
MAL1-5		8/18/2025	Drywall & Joint Compound	White with off white paper	Room 104 break room corner by door	Ken Lee ES35910
MAL1-6		8/18/2025	Drywall & Joint Compound	White with off white paper	Room 113 conference room NE corner	Ken Lee ES35910
MAL1-7		8/18/2025	Drywall & Joint Compound	White with off white paper	Basement elevator lobby at corner by stairwell door	Ken Lee ES35910
MAL1-8		8/18/2025	Drywall & Joint Compound	White with off white paper	Basement storage room 109 corner by door	Ken Lee ES35910
MAL1-9		8/18/2025	Drywall & Joint Compound	White with off white paper	Stairwell, basement landing, corner by door	Ken Lee ES35910
MAL2-1		8/18/2025	Cove Base & Mastic	6" Tan Vinyl Cove Base & Yellow Mastic	Room 117 by door	Ken Lee ES35910
MAL2-2		8/18/2025	Cove Base & Mastic	6" Tan Vinyl Cove Base & Yellow Mastic	Room 117 corner by door	Ken Lee ES35910
MAL3-1		8/18/2025	Floor Tile & Mastic	12" Vinyl Composition Tile with green & tan streaks and Black Mastic	Middle Stairwell Hallway	Ken Lee ES35910
MAL3-2		8/18/2025	Floor Tile & Mastic	12" Vinyl Composition Tile with green & tan streaks and Black Mastic	Room 132 NE corner	Ken Lee ES35910
MAL4-1		8/18/2025	Plank Flooring & Mastic	Wood look Vinyl plank flooring system and associated mastics	Reception lobby outside room 138 beneath potted plant	Ken Lee ES35910
MAL4-2		8/18/2025	Plank Flooring & Mastic	Wood look Vinyl plank flooring system and associated mastics	Reception lobby hall outside conference room, beneath coat rack	Ken Lee ES35910
MAL5-1		8/18/2025	Adhesive	Yellow Carpet Adhesive	Room 114 corner by door	Ken Lee ES35910
MAL5-2		8/18/2025	Adhesive	Yellow Carpet Adhesive	Room 135 corner by door	Ken Lee ES35910
MAL6-1		8/18/2025	Ceiling Tile	2'x4' Suspended Acoustical Tile, white w/ small fissures, small holes, dots & light gray through out	Stairwell, middle north side	Ken Lee ES35910

Sample #	Group #	Collection Date	Material	Color/Description	Sample Location	Collected By
MAL6-2		8/18/2025	Ceiling Tile	2x4' Suspended Acoustical Tile, white w/ small fissures, small holes, dots & light gray through out	Room 113 conference room SE corner	Ken Lee ES35910
MAL7-1		8/18/2025	Countertop	Black Laboratory Countertop	Room 103 side of countertop	Ken Lee ES35910
MAL7-2		8/18/2025	Countertop	Black Laboratory Countertop	Room 122 side of countertop	Ken Lee ES35910
MAL8-1		8/18/2025	Grout	4" Ceramic Wall Tile Grout, Off White	Men's Rest Room Shower wall behind door	Ken Lee ES35910
MAL8-2		8/18/2025	Grout	4" Ceramic Wall Tile Grout, Off White	Women's Rest Room Shower wall behind door	Ken Lee ES35910
MAL9-1		8/18/2025	Grout & Mortar	1" Ceramic Floor Tile Grout & Mortar, Light Gray	Men's Rest Room Shower Area, floor behind door	Ken Lee ES35910
MAL9-2		8/18/2025	Grout & Mortar	1" Ceramic Floor Tile Grout & Mortar, Light Gray	Women's Rest Room Shower Area, floor behind door	Ken Lee ES35910
MAL10-1		8/18/2025	Caulk	White, Pliable	Men's rest room sink	Ken Lee ES35910
MAL10-2		8/18/2025	Caulk	White, Pliable	Women's rest room sink	Ken Lee ES35910
MAL11-1		8/18/2025	Caulk	Gray, Pliable	Exterior metal door frame, most NW entrance door	Ken Lee ES35910
MAL11-2		8/19/2025	Caulk	Gray, Pliable	Exterior metal door frame at SW basement entrance door (at bottom of outside stairs)	Ken Lee ES35910
MAL12-1		8/19/2025	Gasket	7" Pipe Flange Gasket, black and brown	Basement cold water line	Ken Lee ES35910
MAL12-2		8/19/2025	Gasket	7" Pipe Flange Gasket, black and brown	Basement cold water line	Ken Lee ES35910
MAL13-1		8/19/2025	Gasket	7" Pipe Flange Gasket, Red	Basement cold water line	Ken Lee ES35910
MAL13-2		8/19/2025	Gasket	7" Pipe Flange Gasket, Red	Basement cold water line	Ken Lee ES35910
MAL14-1		8/19/2025	Gasket	7" Pipe Flange Gasket, black	Basement cold water line close to water gauge	Ken Lee ES35910
MAL14-2		8/19/2025	Gasket	7" Pipe Flange Gasket, black	Basement cold water line close to water gauge	Ken Lee ES35910
MAL15-1		8/19/2025	Sealer	White Elastomeric Vapor Sealing Pipe Insulation Mastic	Boiler room pipe insulation end coating	Ken Lee ES35910

Sample #	Group #	Collection Date	Material	Color/Description	Sample Location	Collected By
MAL15-2		8/19/2025	Sealer	White Elastomeric Vapor Sealing Pipe Insulation Mastic	Boiler room pipe insulation end coating by door	Ken Lee ES35910
MAL16-1		8/19/2025	Grout & Mortar	6" Gray Quarry Tile Grout & Mortar, Gray	Room 103, in center below a desk area, under trash can	Ken Lee ES35910
MAL16-2		8/19/2025	Grout & Mortar	6" Gray Quarry Tile Grout & Mortar, Gray	Room 122, floor by north door to corridor	Ken Lee ES35910
MAL17-1		8/19/2025	Sheet Flooring & Mastic	Off White & Tan Sheet Flooring and Tan Mastic	Room 125 closet	Ken Lee ES35910
MAL17-2		8/19/2025	Sheet Flooring & Mastic	Off White & Tan Sheet Flooring and Tan Mastic	Room 125 by entry door	Ken Lee ES35910
MAL18-1		8/19/2025	Floor Tile & Mastic	12" Blue Vinyl Composition Tile with Maroon 12" Accent Tiles, both with black mastic	Room 104 break room by door, under floor mat	Ken Lee ES35910
MAL18-2		8/19/2025	Floor Tile & Mastic	12" Blue Vinyl Composition Tile with Maroon 12" Accent Tiles, both with black mastic	Room 104 in corner beneath recycle containers	Ken Lee ES35910
MAL19-1		8/19/2025	Plank Flooring, Floor tile & Mastic	Top Layer Wood look vinyl plank flooring with floor tile beneath & associated mastics	Lab corridor, west end beneath potted plant	Ken Lee ES35910
MAL19-2		8/19/2025	Plank Flooring, Floor tile & Mastic	Top Layer Wood look vinyl plank flooring with floor tile beneath & associated mastics	Room 132 entry hall off lab corridor, behind door	Ken Lee ES35910
MAL20-1		8/19/2025	Cove Base & Mastic	4" Brown Vinyl Cove Base & Tan Mastic	Room 132 entry hall by door	Ken Lee ES35910
MAL20-2		8/19/2025	Cove Base & Mastic	4" Brown Vinyl Cove Base & Tan Mastic	Outside of Room 117 entry door	Ken Lee ES35910
MAL21-1		8/19/2025	Cove Base & Mastic	4" Gray Vinyl Cove Base & Tan Mastic	Room 114 corner by door	Ken Lee ES35910
MAL21-2		8/19/2025	Cove Base & Mastic	4" Gray Vinyl Cove Base & Tan Mastic	Room 137 by door	Ken Lee ES35910
MAL22-1		8/19/2025	Cove Base & Mastic	4" Tan Vinyl Cove Base & Tan Mastic	Women's rest room by door	Ken Lee ES35910
MAL22-2		8/19/2025	Cove Base & Mastic	4" Tan Vinyl Cove Base & Tan Mastic	Room 125 closet	Ken Lee ES35910
MAL23-1		8/19/2025	Cove Base & Mastic	4" Black Vinyl Cove Base & Tan Mastic	Room 120 by north door to corridor	Ken Lee ES35910
MAL23-2		8/19/2025	Cove Base & Mastic	4" Black Vinyl Cove Base & Tan Mastic	Room 122 lab cabinet base	Ken Lee ES35910
MAL24-1		8/19/2025	Caulk	Black Interior Window Caulk between glass & frame	Room 117 middle window	Ken Lee ES35910

Sample #	Group #	Collection Date	Material	Color/Description	Sample Location	Collected By
MAL24-2		8/19/2025	Caulk	Black Interior Window Caulk between glass & frame	Conference room hallway window	Ken Lee ES35910
MAL25-1		8/19/2025	Carpet adhesives	Newer and Older Yellow Carpet Adhesive Layers	Room 117 by door	Ken Lee ES35910
MAL25-2		8/19/2025	Carpet adhesives	Newer and Older Yellow Carpet Adhesive Layers	Room 117 by door	Ken Lee ES35910
MAL26-1		8/19/2025	Insulation	Yellow Fibrous	Stairwell hall between roof decking & bar joist NE	Ken Lee ES35910
MAL26-2		8/19/2025	Insulation	Yellow Fibrous	Stairwell hall between roof decking & bar joist NW	Ken Lee ES35910
MAL26-3		8/19/2025	Insulation	Yellow Fibrous	Stairwell I-beam below roof decking on West elevation	Ken Lee ES35910
MAL27-1		8/19/2025	Caulk	White Interior	Room 125 door frame into the stairwell hallway	Ken Lee ES35910
MAL27-1		8/19/2025	Caulk	White Interior	1st floor elevator door frame	Ken Lee ES35910
MAL28-1		8/19/2025	Caulk	Interior Gray Door Caulk, Pliable	Interior side of door frame to outside in south stairwell hallway	Ken Lee ES35910
MAL28-2		8/19/2025	Caulk	Interior Gray Door Caulk, Pliable	Interior side of door frame from room 125 stage area to outside	Ken Lee ES35910
MAL29-1		8/19/2025	Caulk	White, Pliable	Exterior east end wall, 1" caulk between wall panels	Ken Lee ES35910
MAL29-2		8/19/2025	Caulk	White, Pliable	Exterior south west side by canopy, 1" caulk between wall panels	Ken Lee ES35910
MAL30-1		8/19/2025	Caulks	Exterior Black & White Caulk	East end fiberglass wall aluminum band	Ken Lee ES35910
MAL30-2		8/19/2025	Caulks	Exterior Black & White Caulk	West end fiberglass wall on aluminum band	Ken Lee ES35910
MAL31-1		8/19/2025	Waterproofing	Black Peeling Waterproof Coating	West exterior foundation	Ken Lee ES35910
MAL31-2		8/19/2025	Waterproofing	Black Peeling Waterproof Coating	North exterior foundation	Ken Lee ES35910
MAL32-1		8/21/2025	Seam Filler	Black, Hard Labtop Seam Filler	Room 122 West side of the east lab countertop seam	Ken Lee ES35910
MAL32-2		8/21/2025	Seam Filler	Black, Hard Labtop Seam Filler	Room 122 East side of the east lab countertop seam	Ken Lee ES35910

[illegible]

¹Type: A=area B=blank P=personal E=excursion ²Beginning/End of Sample Period ³Pump Calibration in Liters/Minute ⁴Volume in Liters (time in min * flow in L/min)

Sampled by		Relinquished to lab by				Sample Disposal:	
Name: KENNETH LEE		Name: KENNETH LEE				☐ Return to Sender ☐ Disposal by lab	
Signature: Ken Lee		Signature: Ken Lee				Shipping Methods	
Date/Time: 8/21/25 1700		Date/Time: 8/21/25 1700				☐ Receive a physical copy of report ☐ UPS ☐ FX ☐ USM ☐ HD ☐ D	
☐ Sample Return Requested ☐ Ambient temp ☐ Ice ☐ CI ☐ R ☐ S ☐ X							

*Temperature taken with IR Gun A. **Required. Chain-of-Custody documentation continued internally within lab. Terms and conditions page 2.



Analysis Report

Schneider Laboratories Global, Inc

2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • Fax 804-359-1475

Customer: Dayton Environmental Testing, LLC (4738)
Address: 2750-B Indian Ripple Rd
Suite 211
Dayton, OH 45440

Order #: 644470

Attn:

Received 09/03/25
Analyzed 09/03/25
Reported 09/05/25

Project: City of Dayton Miami Water
Location: 3210 Chuck Wagner Lane Dayton
Number: 25-296-0730.3

Method: EPA 600/R-93/116 & 40 CFR App. E Sub. E Pt. 763

PLM Analysis

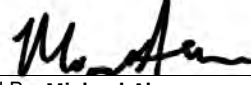
Sample ID	Collected	Cust. ID	Location	Asbestos Fibers	Other Materials
644470-001	09/02/25	MAL41-1	Men's RR E Shower RM		
Layer 1: Mastic Tan, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL
644470-002	09/02/25	MAL41-2	Women's RR W Shower RM		
Layer 1: Mastic Tan, Soft				No Asbestos Detected	100% NON FIBROUS MATERIAL

EPA Regulatory Limit: 1%

Total layers analyzed on order: 2

644470-09/05/25 04:18 PM

Analyst  Thoria Nadiem


Reviewed By: Michael Alers
Analyst

Reporting Limit: 1% Gravimetrically Reduced Reporting Limit: 0.01% PLM analysis is based on Visual Estimation and NESHAP recommends that any friable sample with an asbestos content less than 10 percent be verified by Point Count or TEM Analysis. The EPA recommends that any attic loose fill vermiculite should be treated as asbestos containing material. This report must not be reproduced except in full with the approval of the laboratory. The test results apply to the sample as received.

*Temperature taken with IR Gun A. **Required. Chain-of-Custody documentation continued internally within lab. Terms and conditions page 2.

Sample #	Group #	Collection Date	Material	Color/Description	Sample Location	Collected By
MAL41-1		9/2/2025	Mastic tile adhesive	Tan mastic	Men's rest room east shower room wall	Ken Lee ES35910
MAL41-2		9/2/2025	Mastic tile adhesive	Tan mastic	Women's rest room west shower room wall	Ken Lee ES35910

ATTACHMENT E
PHOTOGRAPHS

Photographs

Pre-Renovation Asbestos Survey
City of Dayton - Miami Water Treatment Plant
Administration and Laboratory Building
3210 Chuck Wagner Lane, Dayton, Ohio 45414
Date of Photographs: August 18, 2025 to August 20, 2025



Photograph 1
HA ID 1 = Non-ACM



Photograph 2
HA ID 2 = Non-ACM



Photograph 3
HA ID 3 = Non-ACM



Photograph 4
HA ID 4 = Non-ACM

Photographs

Pre-Renovation Asbestos Survey
City of Dayton - Miami Water Treatment Plant
Administration and Laboratory Building
3210 Chuck Wagner Lane, Dayton, Ohio 45414
Date of Photographs: August 18, 2025 to August 20, 2025



Photograph 5
HA ID 5 = Non-ACM



Photograph 6
HA ID 6 = Non-ACM



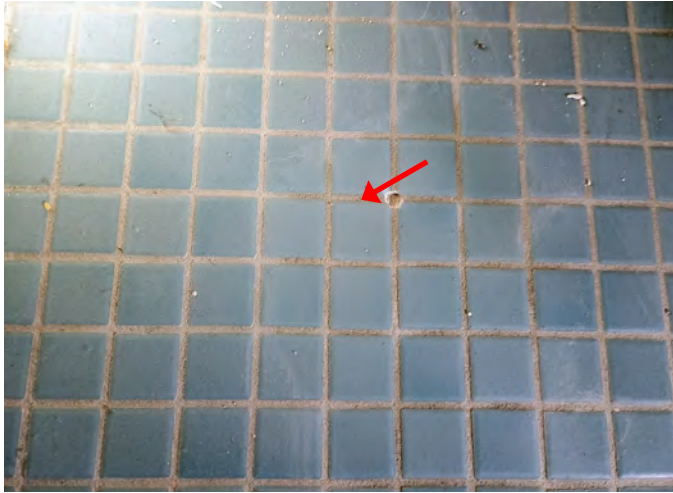
Photograph 7
HA ID 7 = Non-ACM



Photograph 8
HA ID 8 = Non-ACM

Photographs

Pre-Renovation Asbestos Survey
City of Dayton - Miami Water Treatment Plant
Administration and Laboratory Building
3210 Chuck Wagner Lane, Dayton, Ohio 45414
Date of Photographs: August 18, 2025 to August 20, 2025



Photograph 9
HA ID 9 = Non-ACM



Photograph 10
HA ID 10 = Non-ACM



Photograph 11
HA ID 11 = Non-ACM



Photograph 12
HA ID 12 = Non-ACM

Photographs

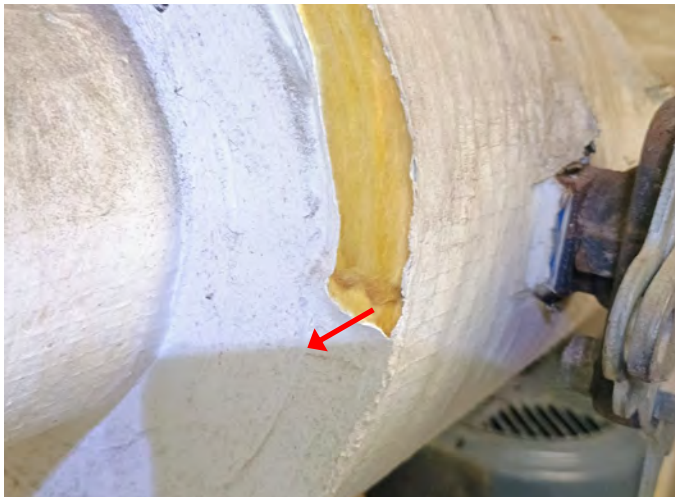
Pre-Renovation Asbestos Survey
City of Dayton - Miami Water Treatment Plant
Administration and Laboratory Building
3210 Chuck Wagner Lane, Dayton, Ohio 45414
Date of Photographs: August 18, 2025 to August 20, 2025



Photograph 13
HA ID 13 = Non-ACM



Photograph 14
HA ID 14 = Non-ACM



Photograph 15
HA ID 15 = Non-ACM



Photograph 16
HA ID 16 = Non-ACM

Photographs

Pre-Renovation Asbestos Survey
City of Dayton - Miami Water Treatment Plant
Administration and Laboratory Building
3210 Chuck Wagner Lane, Dayton, Ohio 45414
Date of Photographs: August 18, 2025 to August 20, 2025



Photograph 17
HA ID 17 = Non-ACM



Photograph 18
HA ID 18 = Non-ACM



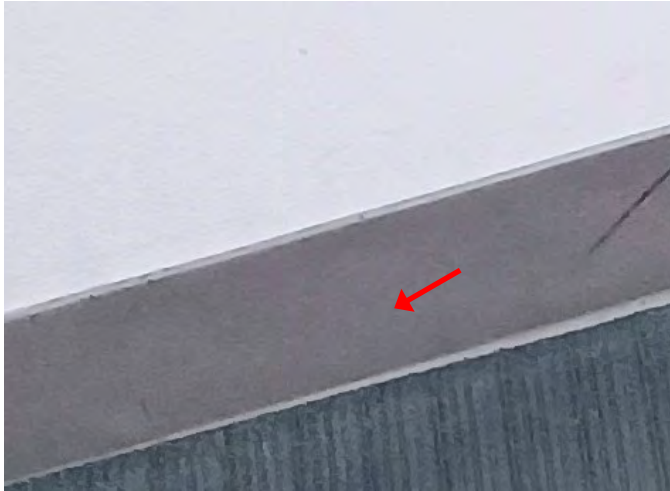
Photograph 19
HA ID 19 = Non-ACM



Photograph 20
HA ID 20 = Non-ACM

Photographs

Pre-Renovation Asbestos Survey
City of Dayton - Miami Water Treatment Plant
Administration and Laboratory Building
3210 Chuck Wagner Lane, Dayton, Ohio 45414
Date of Photographs: August 18, 2025 to August 20, 2025



Photograph 21
HA ID 21 = Non-ACM



Photograph 22
HA ID 22 = Non-ACM



Photograph 23
HA ID 23 = Non-ACM



Photograph 24
HA ID 24 = Non-ACM

Photographs

Pre-Renovation Asbestos Survey
City of Dayton - Miami Water Treatment Plant
Administration and Laboratory Building
3210 Chuck Wagner Lane, Dayton, Ohio 45414
Date of Photographs: August 18, 2025 to August 20, 2025



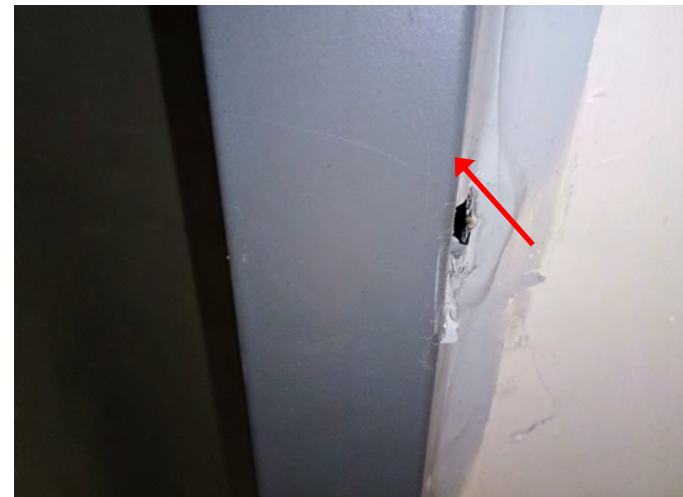
Photograph 25
HA ID 25 = Non-ACM



Photograph 26
HA ID 26 = Non-ACM



Photograph 27
HA ID 27 = Non-ACM



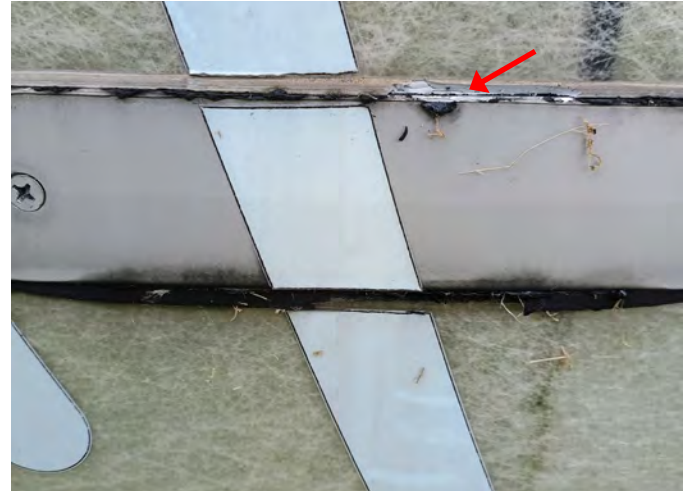
Photograph 28
HA ID 28 = Non-ACM

Photographs

Pre-Renovation Asbestos Survey
City of Dayton - Miami Water Treatment Plant
Administration and Laboratory Building
3210 Chuck Wagner Lane, Dayton, Ohio 45414
Date of Photographs: August 18, 2025 to August 20, 2025



Photograph 29
HA ID 29 = Non-ACM



Photograph 30
HA ID 30 = Non-ACM



Photograph 31
HA ID 31 = Non-ACM



Photograph 32
HA ID 32 = Non-ACM

Photographs

Pre-Renovation Asbestos Survey
City of Dayton - Miami Water Treatment Plant
Administration and Laboratory Building
3210 Chuck Wagner Lane, Dayton, Ohio 45414
Date of Photographs: August 18, 2025 to August 20, 2025



Photograph 33
HA ID 33 = Assumed ACM



Photograph 34
HA ID 34 = Assumed ACM



Photograph 35
HA ID 35 = Assumed ACM



Photograph 36
HA ID 36 = Assumed ACM

Photographs

Pre-Renovation Asbestos Survey
City of Dayton - Miami Water Treatment Plant
Administration and Laboratory Building
3210 Chuck Wagner Lane, Dayton, Ohio 45414
Date of Photographs: August 18, 2025 to August 20, 2025



Photograph 37
HA ID 37 = Assumed ACM



Photograph 38
HA ID 38 = Assumed ACM



Photograph 39
HA ID 39 = Assumed ACM



Photograph 40
HA ID 40 = Assumed ACM

Photographs

Pre-Renovation Asbestos Survey
City of Dayton - Miami Water Treatment Plant
Administration and Laboratory Building
3210 Chuck Wagner Lane, Dayton, Ohio 45414
Date of Photographs: August 18, 2025 to August 20, 2025



Photograph 41
HA ID 41 = Non-ACM



Photograph 42
HA ID 42 = Assumed ACM

ATTACHMENT F
QUALIFICATIONS OF ASSESSOR



Mike DeWine, Governor
Jon Husted, Lt. Governor
Anne M. Vogel, Director

2/19/2025

Michael Lee
Michael B. Lee
P.O. Box 1084
Marysville, OH 43040

RE: Evaluation Specialist
Certification Number: ES34954
Expiration Date: 3/10/2026

Dear Michael Lee:

This letter and enclosed certification card approves your request to be certified as an asbestos Evaluation Specialist. You must present your card upon request at any project site while performing duties. Copies of cards are not acceptable as proof of certification.

This certification may be revoked by the Director of the Ohio Environmental Protection Agency (EPA) for violation of any of the requirements of 3745-22 or 3745-20 of the Ohio Administrative Code.

If you have any questions, please contact the Asbestos Program at 614-644-0226 or by email at asbestoslicensing@epa.ohio.gov.

Sincerely,

Brandon M. Schwendeman
Brandon Schwendeman
Manager, Business Operations Support Section
Ohio EPA - Division of Air Pollution Control





**Environmental
Protection
Agency**

EPA.Ohio.gov

Mike DeWine, Governor Jim Tressel, Lt. Governor John Logar, Director

5/19/2025

Kenneth Lee
1281 Elmdale Dr
Kettering, OH 45409

RE: Evaluation Specialist
Certification Number: ES35910
Expiration Date: 6/9/2026

Dear Kenneth Lee:

This letter and enclosed certification card approves your request to be certified as an asbestos Evaluation Specialist. You must present your card upon request at any project site while performing duties. Copies of cards are not acceptable as proof of certification.

This certification may be revoked by the Director of the Ohio Environmental Protection Agency (EPA) for violation of any of the requirements of 3745-22 or 3745-20 of the Ohio Administrative Code.

If you have any questions, please contact the Asbestos Program at 614-644-0226 or by email at asbestoslicensing@epa.ohio.gov.

Sincerely,

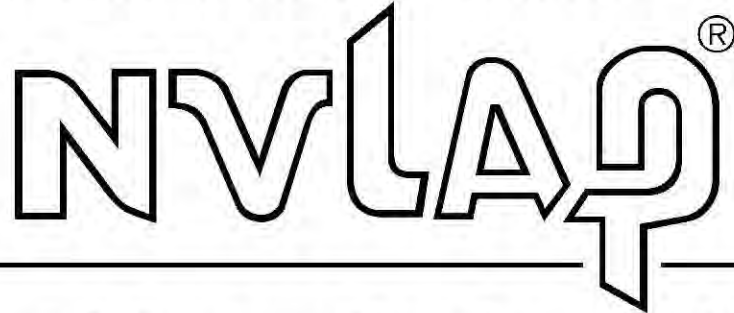
Brandon M. Schwendeman

Brandon Schwendeman
Manager, Business Operations Support Section
Ohio EPA - Division of Air Pollution Control



ATTACHMENT G
LABORATORY'S NVLAP CERTIFICATE

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 101150-0

Schneider Laboratories Global, Inc.
Richmond, VA

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:*

Asbestos Fiber Analysis

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communiqué on ISO/IEC 17025).*

2025-04-01 through 2026-03-31

Effective Dates

A handwritten signature in blue ink, reading "Dana S. Laman".

For the National Voluntary Laboratory Accreditation Program

**SECTION 03 2000
CONCRETE REINFORCEMENT**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.
- B. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.2 SUMMARY

- A. Provide concrete and masonry reinforcement as indicated. The Work includes fabrication and placement of reinforcement for cast-in-place concrete including bars, welded wire fabric, ties, and supports.
- B. Related Work Specified Elsewhere:
 - 1. Division 1 - Quality Control: For inspection of reinforcing steel placement.
 - 2. Section 03 30 00 - Cast-in-Place Concrete.
 - 3. Division 4 - Masonry Reinforcement and Anchoring: For reinforcement for unit masonry.
- C. Refer to Division 1 for Alternates that may affect the Work of this Section.

1.3 SUBMITTALS

- A. Product Data
 - 1. Submit manufacturer's specifications and installation instructions for proprietary materials and reinforcement accessories.
- B. Shop Drawings
 - 1. Submit shop drawings for fabrication, bending, and placement of concrete and masonry reinforcement. Comply with the ACI 315-latest edition "Details and Detailing of Concrete Reinforcement". Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements, and assemblies as required for the fabrication and placement of concrete reinforcement. Show building plans with bar sizes, spacing, and quantities for all bent and straight reinforcing bars. For walls, floor slabs, and roof slabs with openings or special reinforcing details, show elevations or plans detailing all reinforcing.
- C. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Steel reinforcement and reinforcement accessories.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with requirements of the latest edition of the following codes and standards, except as herein modified:
 - 1. American Welding Society, AWS D 1.4, latest edition - "Structural Welding Code - Reinforcing Steel."

2. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."
3. American Concrete Institute, ACI 318-latest edition "Building Code Requirements for Reinforced Concrete."

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver reinforcement to the project site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- B. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or excessive rust.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Reinforcing Bars (Rebar): ASTM A615, and as follows:
 1. Provide Grade 60 (Grade 420), deformed for bars No. 3 to 11, except as otherwise indicated.
 2. Provide Low-Alloy Steel Reinforcing Bars, ASTM A706 deferred bars, where welding of reinforcing is required.
- B. Steel Wire: ASTM A82, as shown.
- C. Welded Wire Fabric (WWF): ASTM A185, fabricated from cold steel wire into flat sheets.
 1. Provide sheet stock only for interior slab on grade (roll stock not acceptable).
 2. Fiber reinforcement shall not be substituted for WWF.
- D. Supports for Reinforcement (including welded wire fabric): Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place.
 1. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.
 2. Over waterproof membranes, use precast concrete chairs to prevent penetration of the membrane.
 3. For footings, trench footings, slabs on grade, and grade beams use precast concrete bricks ($f'_c = 3000$ psi min. at 28 days). (Concrete masonry bricks not acceptable.)
 4. For concrete masonry bond beams use #3 bar laterally, tied to each longitudinal reinforcing bar below to hold bars apart and up from bottom. Space #3 bars at 48 inches o.c.
- E. Adhesive Anchor Bolts (In Concrete): Chemically grouted adhesive anchor bolts. Subject to compliance with requirements, provide one of the following:
 1. Products: Subject to compliance with specified requirements, provide one of the following:
 - a. HILTI HVA Adhesive Anchors; Hilti, Inc., Tulsa, Oklahoma.
 - b. EPCON System Ceramic 6 Adhesive Anchors; ITW Ramset/Red Head, Wood Dale, Illinois.
 - c. Chem-Stud Adhesive Anchors; Powers Fasteners, Inc., New Rochelle, New York.

- d. Simpson Set Epoxy-Tie Adhesive Anchors; Simpson Strong-Tie Company, Inc, Pleasanton, California.
2. Anchors to be ASTM A193, Grade B7 galvanized steel threaded rods (Fy = 105 ksi) unless otherwise noted.
3. Where noted on the drawings anchors to be ASTM F593, Condition CW stainless steel threaded rods (Fy = 65 ksi for diameters 3/8 inch through 5/8 inch and Fy = 45 ksi for diameters 3/4 inch through 1-1/4 inch).
4. Anchors to be installed in strict conformance to manufacturer's installation instructions.
5. Adhesive and Epoxy Anchors shall have the following minimum allowable load capacities:
6. (Based on embedment in 4000 psi concrete and a minimum safety factor on ultimate load capacities or 3.5. Use proportional allowable loads for other strengths of concrete.)

<u>Size</u>	<u>Allowable Shear</u>	<u>Allowable Tension</u>	<u>Minimum</u>
<u>Embedment</u>			
3/8 inch	2000 lbs.	2000 lbs.	3-1/2 inch
1/2 inch	3500 lbs.	4150 lbs.	4-1/4 inch
5/8 inch	5500 lbs.	5200 lbs.	5 inch
3/4 inch	8000 lbs.	9000 lbs.	6-5/8 inch
1 inch	14,000 lbs.	13,500 lbs.	8-1/4 inch

- F. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, [1/2 to 1-1/2 inches] long. Dosage shall be 3 lb per cu yd.

2.2 FABRICATION

- A. General: Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI "Manual of Standard Practice." In case of fabricating errors, do not rebend or straighten reinforcement in a manner that will injure or weaken the material.
- B. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the work.
 1. Bar lengths, depths, and bends exceeding specified fabrication tolerances.
 2. Bends or kinks not indicated on Drawings or final shop drawings.
 3. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The installer must examine the substrate and the conditions under which concrete reinforcement is to be placed and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
- B. The Architect shall be notified by the Contractor for this Section shall notify the A/E when steel placement for a concrete pour is nearing completion so that the Work may be observed.

3.2 INSTALLATION

- A. Comply with the specified codes and standards and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified.
 - 1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- C. Position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by precast concrete brick, metal chairs, runners, bolsters, spacers, and hangers as required.
- D. Place reinforcement to obtain the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces. Do not tack weld crossing reinforcing bars.
- E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with 16 gauge wire spaced at 48 inches. Do not make end laps midway between supporting beams or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps.
- F. Provide sufficient numbers of supports and of strength to support reinforcement in the correct position as detailed in the plans. Do not place reinforcing bars more than 2 inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
- G. Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly tying wire. Comply with requirements of ACI 318 for minimum lap of spliced bars.
- H. Reinforcing steel installed in continuous footings shall run continuously. This shall include specially shaped components with proper lap where corner reinforcing and step footings occur.
- I. Provide additional reinforcing around required openings in footings, and slabs having a one foot least dimension.
- J. Support welded wire fabric in slabs on grade with precast concrete bricks at 2 feet spacing in both directions.
- K. Provide continuous chairs or bolsters to support welded wire fabric in elevated slabs at each line of support for the steel deck (e.g., at centerline of supporting joists or beams) and as required to support reinforcing steel in the correct position as detailed in the Plans.

END OF SECTION

**SECTION 03 3000
CAST-IN-PLACE CONCRETE**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.
- B. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.2 SUMMARY

- A. Provide interior and exterior concrete work as indicated.
- B. This Section includes, but is not necessarily limited to:
 - 1. Exterior Concrete
 - a. Paving, walks, curbs, ramps, steps, retaining wall, and stem walls
 - b. Aprons, stoops, Exterior piers and foundations
 - c. Flagpole base
 - d. Building identification signage foundation
 - 2. Interior Floor slabs; on grade, elevated, subgrade
 - a. Bases, curbs, risers, and steps, elevated, on grade
 - b. Foundations, footings, pads, piers, columns, beams
 - c. Pits for trench drains, pipe trenches
 - d. Recesses for floor finishes requiring same
 - e. Retaining walls
- C. Provide other cast-in-place concrete and related work as indicated for complete and finished work, except concrete work specifically designated to be provided under the Work of other Sections of these Specifications.
- D. Refer to Concrete Schedule following this Section.
- E. The following is concrete work done by other Sections, but meeting the requirements of this Section (unless indicated otherwise).
 - 1. Equipment pads and bases required by Divisions 15 and 16.
 - 2. Encasement of underground utilities or connections.
 - 3. Specifically excluded items.
 - 4. Related Work Specified Elsewhere
- F. Related Work Specified Elsewhere
 - 1. Division 1 – Quality Control: For concrete testing
 - 2. Division 31 – Earthwork: For under slab drainage fill
 - 3. Section 05 10 00 - Structural Metal Framing
 - 4. Section 05 30 00 - Metal Decking
 - 5. Division 4 – Masonry

- G. Refer to Division 1 for Alternates that may affect the Work of this Section.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's data on component and accessory items including cement, fly ash, admixtures, joint materials, bonding agent, curing materials, floor treatment, floor sealer, perimeter insulation, and self-leveling underlayment.
1. Include installation instructions where applicable.
- B. Shop Drawing for Joints: Where Contractor elects to propose Alternative locations for slab on grade control, construction, and expansion joints, submit a revised slab plan of the same scale as on the plans showing all proposed control and construction joint locations.
- C. Mix Design: Prepare and submit to the A/E for review design mixes for each type of concrete. Use an independent testing facility acceptable to the A/E for testing the compressive strength of the proposed mix designs. Submit compression test results for each design mix. Test report must clearly indicate design mix for which it applies. Each design mix must indicate the types of structures in which it is to be used.
1. Sample design mix submittal form is enclosed herein.
- D. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
1. Cementitious materials and aggregates.
 2. Curing materials
 - a. Certify materials used are compatible with finishes specified.
 3. Admixtures

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified:
1. ACI 117-latest edition "Standard Tolerances for Concrete Construction and Materials."
 2. ACI 211.1-latest edition "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete."
 3. ACI 212 "Chemical Admixtures for Concrete."
 4. ACI 301-latest edition "Specifications for Structural Concrete."
 5. ACI 302.1R-latest edition "Guide for Concrete Floor and Slab Construction."
 6. ACI 304R-latest edition "Guide for Measuring, Mixing, Transporting, and Placing Concrete."
 7. ACI 305 "Cold Weather Concreting."
 8. ACI 306 "Hot Weather Co."
 9. ACI 308 "Standard Practice for Curing Concrete."
 10. ACI 311.4R-latest edition "Guide for Concrete Inspection."
 11. ACI 318-latest edition "Building Code Requirements for Reinforced Concrete and Commentary"
 12. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."
 13. Comply with building code requirements, which are more stringent than the above.
 14. ASTM C33 "Standard Specification Curing Concrete."
 15. ASTM C94 "Standard Specification for Ready-Mix Concrete."
 16. ASTM C260 "Standard Specification for Air Entraining Admixtures for Concrete."
 17. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."
 18. ASTM C309 "Standard Specification for Liquid Membrane – Forming Compounds for Curing Concrete."
 19. ASTM C1116 "Standard Specification for Fiber Reinforced Concrete and Shotcrete."

20. ASTM C1315 "Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete."
 21. ASTM E1155 "Determining Floor Flatness and Levelness Using F-Number System."
- B. Concrete ramps and curbs shall be provided to conform with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.
- C. Materials may require testing and retesting, as directed by the A/E, at any time during the progress of the Work. Allow free access to material stockpiles and facilities.
- D. Installation requirements within this Specification Section are not intended to be restrictive, and the Contractor is allowed when reviewed with the A/E's field representative to adjust the means and methods used to meet required tolerances. Compliance with required tolerances is the responsibility of the Contractor, and the A/E or his representative shall not unduly restrict adjustment required to meet these.
- E. Preinstallation Conference: Conduct conference at Project site to comply with Division 1 and the following:
1. Before submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations.
 2. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications.
- F. Curbs shall meet the requirements of the State of Ohio Department of Transportation (ODOT), "Construction and Material Specifications," latest edition.

1.5 SEQUENCING

- A. Trades requiring inserts and sleeves for their work shall furnish same for installation as Work under this Section. Delivery of inserts and sleeves for installation, as Work under this Section shall be timed so as not to cause delay in the progress of this Work.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Proportion mixes by either laboratory trial batch or field experience methods as specified in ACI 301, using materials to be employed on the project for each class of concrete required.
- B. Portland Cement: ASTM C150, Type 1, or type 3 unless otherwise acceptable to A/E.
1. Use same brand and source of cement throughout project.
- C. Fly Ash: ASTM C618-89A, Type C or F, may be substituted for up to 20 percent of the total cementitious materials in all concrete mixes unless otherwise noted.
- D. Normal Weight Aggregates: ANSI/ASTM C33, class 3S normal weight aggregate, not exceeding 1 ½ inch nominal size, uniformly graded, and as herein specified.
1. Fine Aggregate: Clean, sharp, natural sand free from loam, clay lumps, or other deleterious substances.
 2. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:

- a. Crushed stone, processed from natural rock or stone.
 - b. Washed gravel, either natural or crushed. Use of pit or bank-run gravel is not permitted.
 - c. Maximum Aggregate Size: Not larger than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourths of minimum clear spacing between individual reinforcing bars or bundles of bars or 1 ½" nominal size, whichever is stricter.
 - d. Exterior concrete shall have crushed limestone aggregate.
3. Aggregate Supply: Provide aggregates from one source of supply to ensure uniformity in color, size, and shape.
4. Lightweight Aggregate: ASTM C330.
- E. Water: Potable and complying with ASTM C 94.
- F. Self-Expanding Strip Water Stops: Manufactured rectangular or trapezoidal strip, sodium benotite or other hydrophilic material for adhesive bonding to concrete. Products: Subject to compliance with requirements, provide one of the following:
 1. Voclay Water Stop – RX; Colloid Environmental Technologies Co., Arlington Heights, Illinois.
 2. Hydrolite; Greenstreak, St. Louis, Missouri
 3. Mirastop; Mirafi Moisture Protection, Div. of Royal Ten Cate (USA), Inc. Norcross, Georgia.
 4. Superstop; Tremco Inc., Cleveland, Ohio
 5. DB-1; W.R. Grace & Company, Cambridge, Massachusetts
- G. Performed Expansion Joint Fillers:
 1. Provide closed cell polyethylene expansion joints. Subject to requirements of these specifications provide one of the following:
 - a. Sonolastic Expansion – Joint Filler; Sonneborn Building Products, Shakopee, Minnesota.
 - b. Deck-O-Foam; W.R. Meadows, Inc., Elgin, Illinois
 - c. Econ-O-Foam; Williams Products, Inc., Troy, Michigan.
 - d. Foamtech; NMW, Inc.
- H. Preformed Isolation Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork, ¼ inch maximum thickness.
- I. Removable Cap Strip:
 1. Provide PVC removable cap strips as manufactured by one of the following:
 - a. BoMetals, Inc., Powder Springs, Georgia
 - b. Vinylex Corporation, Knoxville, TN
 - c. W.R. Meadows, Elgin, IL
 - d. Form-A-Key Products, Louisville, KY
- J. Chemical Bonding Agent: Film-forming, freeze-thaw resistant acrylic latex admixture and bonding agent suitable for brush or spray application, complying with ASTM C881. Subject to compliance with requirements, provide one of the following:
 1. Adbond (J40); Dayton Superior Corp., Oregon, Illinois.
 2. Euroweld; Euclid Chemical, Cleveland, Ohio.
 3. Everbond; L&M Construction Chemicals, Omaha, Nebraska
 4. Acrylic Additive; Sonneborn Building Products, Shakopee, Minnesota
 5. Intralok; W.R. Meadows, Inc., Elgin, Illinois

6. Strong Bond; Conspec Marketing & Manufacturing Co., Inc., Kansas City, Kansas

K. Concrete Curing Materials

1. Moisture-Retaining Cover: One of the following, complying with ANSI-ASTM C171 for concrete floors, that are to be exposed or to receive floor sealer.
 - a. Waterproof paper
 - b. Polyethylene film
 - c. White burlap-polyethylene sheet
2. Water Borne Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound, complying with ANSI/ASTM C309, Type I, Class B, with 18 to 22 percent minimum solids. In accordance with ACI 302.1R-96, "Guide for Concrete Floor and Slab Construction", a letter of compatibility with applied finishes must be issued by the compound manufacturer. Compounds found to be incompatible with finish shall be abrasively removed by applicator at no cost to the Owner or finish trade. Subject to compliance with requirements, provide one of the following for concrete floors that are to receive applied finished floor materials.
 - a. Masterkure 100W; Master Builders, Cleveland, Ohio
 - b. Safe Cure & Seal (J18); Dayton Superior, Oregon, Illinois.
 - c. Diamond Clear VOX; Euclid Chemical Co., Cleveland, Ohio
 - d. Kure-n-Seal-WB; Sonneborn Building Products, Shakopee, Minnesota
 - e. Vocomp-20; W.R. Meadows, Inc., Elgin, Illinois
 - f. Conspec 21; Conspec Marketing & Manufacturing Company, Inc., Kansas City, Kansas
 - g. Klear-Kote WB II 20; Burke, Long Beach, California.

L. Liquid Concrete Floor Hardener (LCFH): Chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

1. Approval Products:
 - a. Titan Hard by Burke by Edoco
 - b. Diamond Hard by Euclid
 - c. J-17 by Dayton Products
 - d. or Approved Equal

M. Dry Shake Concrete Hardener (DSCH): Provide non-metallic aggregate shake type, non-rusting, non-dusting; application rate as recommended by the manufacturer. Color as selected by A/E or as indicated in List of Finishes.

1. Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:
 - a. Maximent; Master Builders, Inc., Cleveland, Ohio
 - b. Quartzplate; L&M Construction Chemicals, Inc., Omaha, Nebraska
 - c. Harcol; Sonneborn Building Products, Shakopee, Minnesota.
 - d. Burke Non-Metallic Floor Hardener; Burke, Long Beach, California
 - e. Surfex; Euclid Chemical Co., Cleveland, Ohio

N. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C1315, Type

1. Approval Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:

- a. Klear-Kote Cure-Seal-Hardener, 30 percent solids; Burke, Long Beach, California
 - b. Lumiseal WB Plus; L & M Construction Chemicals, Inc., Omaha, Nebraska
 - c. Vocomp-30; W.R. Meadows, Inc, Elgin, Illinois
 - d. Super Diamond Clear Vox; Euclid Chemical Co., Cleveland, Ohio
- O. Perimeter Insulation: ASTM C578, Type IV, density 1.6 lb. / cu. ft. minimum, compressive strength 40 psi.
1. Rigid Insulation (Perimeter Insulation and Protection Board): Shall be rigid closed cell extruded polystyrene thermal board. Insulation shall be 2 inches thick unless otherwise noted, and have an aged "R" value of 10.
- a. Approved Products
 - 1) Styrofoam Square Edge; Dow Chemical, Midland, Michigan
 - 2) Foamular250; Owens Corning, Toledo, Ohio
 - 3) Amofom CM; Tenneco Building Products, Smyrna, Minnesota
 - 4) Certifoam; Diversiform Products, New Brighton, Minnesota
 - b. Adhesive for Bonding Insulation: Product with demonstrated capacity to bond insulation securely to substrates indicated without damaging insulation and substrates.
 - 1) Approved Products: Subject to compliance with requirements, provide one of the following:
 - i) PL Premium; OSI Sealants, Inc., Mentor, Ohio
 - ii) DAP Big Stick; DAP Inc., Baltimore, MD
 - iii) Henry #238; W.W. Henry Co.
- P. Self-Leveling Underlayment (if required for patching and repair)
1. Self-leveling cement-based. When mixed with water, it becomes a fluid material, seeking its own level, producing a smooth surface. Compressive strength: 4100 psi minimum at 28 days. Flexural strength: 1300 psi at 28 days. Tensile strength: 750 psi at 28 days. Shrinkage: .025 after 7 days.
- a. Approved Products:
 - 1) Thoro Underlayment; Thoro System Products, Centerville, Indiana
 - 2) Ardex K-15; Ardex, Inc., Pittsburgh, PA
 - 3) LeveLayer II; Dayton Superior Corporation, Oregon, Illinois
 - 4) Topping 112; Master Builders Inc., Cleveland, Ohio
 - 5) 350 Industrial Topping, Burke, Long Beach, California
 - 6) Skimcrete XL; Dependable Chemical Co., Inc., Rocky River, Ohio
 - 7) EZ Level; TEC Specialty Products, Palatine, Illinois
 - 8) F10 Top; Euclid Chemical Co., Cleveland, Ohio
- Q. Epoxy Crack Injection Adhesive (Repair): ASTM C881, Type I, Grade 1, solvent free.
1. Approved Products: Subject to compliance with requirements provide one of the following:
- a. Sikadur 35 Hi-Mod LV; Sika Corp., Lyndhurst, New Jersey
 - b. Sure-Inject (J-56); Dayton Superior Corp., Oregon, Illinois
 - c. EUCO #352 LV; Euclid Chemical Co., Cleveland, Ohio
 - d. Concrecive Standard LVI; Master Builders, Cleveland, Ohio
- R. Vapor Retarder/Barrier: Membrane shall meet the following properties:
- 1. ASTM E - 1643
 - 2. Minimum Permeance: ASTM E-96; 0.04 Perms
 - 3. Water Vapor Barrier: ASTM E-1745; meets or exceeds Class B
 - 4. Thickness of Barrier: ACI 302.1 R-96; not less than 10 mils.

5. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the products specified.
 - a. Stego Wrap (10 mil) Vapor Barrier: Stego Industries, San Juan Capistrano, California.
 - b. Griffolyn T-85 by Reef Industries, Houston TX
 - c. Dura-Scrim D16WB; Raven Industries, Sioux Falls, South Dakota
 - d. Morstop; Fortifiber Corporation, Los Angeles, California
 - e. Plybar Plus II; Glas-Kraft, Inc., Slatersville, Rhode Island
6. Application: Provide under-slab-on-grade, unless otherwise noted. Lap joint minimum of 6 inches and seal as recommended by the manufacturer.

S. Vapor Barrier/Retarder Accessories

1. Seam Tape: High Density Polyethylene Tape with pressure sensitive adhesive. Maximum width 4 inches.
2. Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instruction.

T. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 488; coarse-aggregate grading size 57; with 100 percent passing a 1 inch sieve and not more than 8 percent passing a No. 200 sieve.

U. Reinforcing Steel: ASTM C615 Grade 60, deformed bars.

V. All exterior concrete to conform to construction the latest addition construction and material specifications for the City of Columbus, (COC CMS) Item 499, Class C.

2.2 CONCRETE ADMIXTURES

A. General: Provide admixtures produced by established reputable manufacturers and use in compliance with manufacturer's printed directions. Do not use admixtures, which have not been incorporated and tested in accepted mixes, unless otherwise authorized specifically in writing by A/E.

1. Air-Entraining Admixture: ANSI/ASTM C260.
2. Water-Reducing Admixture: ANSI/ASTM C494, Type A.
3. Set Accelerating Admixture: ANSI/ASTM C494, Type E.
4. Water-Reducing Admixture, mid range: ANSI/ASTM C494, Type E
5. Water-Reducing Admixture, high range: ANSI/ASTM C494, Type F.

B. Use air-entraining admixture in exterior concrete, unless otherwise indicated. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement, having air content within the following limits:

1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals or subjected to hydraulic pressure:
 - a. 5 percent plus/minus 1 percent for 2 inch nominal maximum aggregate size.
 - b. 5-1/2 percent plus/minus 1 percent for 1-1/2 inch nominal maximum aggregate size.
 - c. 6-1/2 percent plus/minus 1 percent for 3/4 and 1 inch nominal maximum aggregate size.
 - d. 7 percent plus/minus 1 percent for 1/2 inch nominal maximum aggregate size.
 - e. Exterior Concrete in Moderate Exposure Regions: 5 percent plus/minus 1 percent for 1 inch nominal maximum aggregate size.

- C. Use of admixtures for water-reducing and set-control shall be permitted only with prior approval of the A/E for each condition and shall be in strict compliance with the manufacturer's directions.
 - 1. Design mix submittals shall include these admixtures and shall indicate which types of concrete structures they are to be used.
- D. Use amount of admixtures as recommended by manufacturer for climatic conditions prevailing at time of placing. Adjust quantities and types of admixtures as required to maintain quality control.
- E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows (these limits pertain to concrete mix prior to addition of super plasticizer, if used):
 - 1. Ramps and Sloping Surfaces: Not more than 3 inches.
 - 2. Reinforced Foundation System: Not less than one inch and not more than 3 inches.
 - 3. Other Concrete: Not less than one inch and not more than 4 inches.
 - 4. Maximum slump with the use of water-reducers to be 8 inches at discharge and 4 inch at placement.
- F. Use of calcium chloride will not be permitted.
- G. Do not use high-range water-reducers in concrete for slabs-on-grade. Mid-range water reducing admixtures will be used for concrete for slabs-on-grade.

2.3 PROPORTIONING AND DESIGN OF MIXES

- A. Proportion mixes by either laboratory trial batch or field experience methods as specified in ACI 301, using materials to be employed on the project for each class of concrete required.
- B. Submit written reports to A/E of each proposed mix for each type of concrete at least 15 days prior to start of Work. Indicate with each mix design the items or structures for which it is to be used. Do not begin concrete production until mixes have been reviewed by A/E. Submit the following information:
 - 1. Complete identification of aggregate source of supply.
 - 2. Tests of aggregates for compliance with specified requirements.
 - 3. Scale weight of each aggregate.
 - 4. Absorbed water in each aggregate.
 - 5. Brand, type, and composition of cement with product information.
 - 6. Brand, type, and amount of each admixture with product information.
 - 7. Amounts of water used in trial mixes.
 - 8. Proportions of each material per cu.yd., including fibrous secondary reinforcement, if used.
 - 9. Gross weight and yield per cu.yd. of trial mixtures.
 - 10. Measured slump, with and without water reducer, if used.
 - 11. Measured air content.
 - 12. Submit compressive strength results from tests performed by an independent testing agency on at least 30 consecutive strength tests or two groups of tests totaling at least 30 within the past 12 months. Supply standard deviation and average strength in accordance with Article 3.9 of ACI 301.
 - 13. Identification number or name of mix to verify agreement with compression test reports.
 - 14. Water/Cement Ratio
- C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as accepted by A/E. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by A/E before using in work.

- D. Maximum Water Cement Ratio: Concrete mixes shall be limited to the water-cement ratios specified in the Concrete Schedule in these Specifications (DIV. 3 - CS-1). Water reducers and fly ash may be used to increase the slump while maintaining or reducing the water-cement ratio at or below the maximums specified values, except where specifically prohibited in these specifications.

2.4 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with the requirements of ASTM C94 and as herein specified.
 - 1. Addition of water to the batch will be permitted only to replace water lost due to evaporation or with verification the design water/cement ratio has not been exceeded and only under the direct control of the concrete testing agency field representative. All water added at the site to be noted on the concrete field inspection report. All tests on concrete to be performed after water is added.
 - 2. During hot weather or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.
 - 3. Flowable fill shall be ready mixed.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Preplacement Observation: Before placing concrete, observe and complete the formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit the installation of their work; cooperate with other trades in setting such work, as required.
 - 1. Observe soil at bottom of foundation systems, which will be subject to testing for soil bearing value by the testing laboratory, as directed by the A/E. Place concrete immediately after approval of foundation excavations.
 - 2. Observe underslab drainage course areas that were subject to testing for soil bearing value by the testing laboratory as required by A/E. Place concrete immediately after approval of underslab compaction tests.
- B. Material placement for interior slabs on grade and exterior concrete stoops.
 - 1. Install and properly anchor the slab welded wire fabric.
 - 2. Position waterstops and expansion joint fillers where indicated on the Drawings and as recommended by manufacturer. Special precautions shall be taken to avoid collapse during installation.
- C. Under slabs-on-grade, place drainage course on prepared subbase and as follows:
 - 1. Compact 6 inch drainage course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
- D. Vapor/Moisture Barrier: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions. Seal joints.
 - 1. Extend moisture barrier up perimeter walls 6 inches and seal top edge with continuous bead of high-grade mildew resistant silicone sealant.

3.2 CONCRETE PLACEMENT

- A. General: Comply with ACI 304 and as herein specified.

1. Deposit concrete, continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.
2. Concrete shall be completely discharged within 1-1/2 hours after entering the conveying drum.
3. Pumping methods using steel or plastic pipelines will be permitted. Aluminum alloy lines shall not be used. Minimum pipe diameter allowed for pumping shall be 3 inches.
4. Pumped Concrete: Comply with ACI 304.

B. Placing Concrete in Forms

1. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
2. Consolidate placed concrete by mechanical vibrating equipment, supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309R-Latest Edition, to suit the type of concrete and project conditions.
3. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the placed layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

C. Placing Concrete Slabs

1. First day test pours shall be a maximum of 1000 SF total size to work out problems and to determine if adjustments are required to attain proper quality of work. Slab pours shall be limited to not greater than 18 feet in width.
2. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.
3. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - a. Consolidate concrete placed in beams and girders of supported slabs, and against bulkheads of slabs on ground, as specified for formed concrete structures. Consolidate concrete in remainder of slabs by vibrating bridge screeds, roller pipe screeds, or other acceptable methods. Limit time of vibrating consolidation to prevent bringing excess fine aggregate to surface.
4. Bring slab surfaces to the correct level with a straightedge and strikeoff. Screeds are required for floor slab work. Use highway straight edge to smooth the surface, leaving it free of humps or hollows. Use of bull floats or darbies will be allowed in conjunction with highway straight edge procedures. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.
5. Maintain reinforcing in the proper position during concrete placement operations. Welded wire fabric may be placed in the plastic concrete after the initial screeding operation. If so placed, the surface shall be screeded, struck off and otherwise finished to correct surface irregularities caused by the placing of the reinforcing.
6. Bonding: Roughen surfaces of set concrete at joints, except where bonding is obtained by use of concrete bonding agent, and clean surfaces of laitance, coatings, loose particles, and foreign matter. Roughen surfaces to expose bonded aggregate uniformly and to not leave laitance, loose particles of aggregate, or damaged concrete at surface.

7. Work edges of exterior slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2 inch radius, unless otherwise shown. Eliminate tool marks on concrete surface.
8. Do not remove forms for 24 hours after concrete has been placed, unless otherwise acceptable to A/E. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by A/E.

D. Cold Weather Placing

1. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306R-88, and as herein specified.
2. When air temperature has fallen or is expected to fall below 40 degrees F, uniformly heat water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50 degrees F, and not more than 80 degrees F, at point of placement.
3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen substrates containing frozen materials.
4. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in writing by the A/E.
5. Do not use set-control admixtures unless otherwise accepted in mix design.
6. A nonchloride accelerating admixture shall be used in all concrete placed in ambient temperatures below 40 degrees F.

E. Hot Weather Placing

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305R-89, and as herein specified.
2. Cool ingredients before mixing to maintain concrete temperatures at time of placement below 90 degrees F. 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 to the total amount of mixing water.
3. 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.
4. Wet forms thoroughly before placing concrete.
5. Do not use retarding admixtures unless otherwise accepted in mix design.

3.3 JOINTS

A. Construction Joints

1. Locate and install construction joints, which are not shown on the Drawings, so as not to impair the strength and appearance of the structure, as acceptable to the A/E.
2. Place construction joints at the end of pours and at locations where placement operations are stopped for a period of more than 1/2 hour, except where such pours terminate at expansion joints.
3. Construct joints as shown, or if not shown, use standard metal keyway section form or form with keyway.
4. Provide keyways at least 1-1/2 inch deep in construction joints in walls, slabs, and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.
5. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.
6. Locate construction joints in interior slabs-on-grade (ground supported), so as to divide the slab into areas not in excess of 4000 sq.ft. (maximum distance of 100 feet in one direction), unless otherwise accepted by the A/E. Conform to slab placement diagrams or pattern layout for placement, where shown on slab plans or submit alternative pour plan showing all proposed joints.

7. Locate construction joints in retaining walls at 60 feet o.c. maximum. Chamfer exposed edges 3/4 inch (u.o.n. as 1/2" in details) and install 1/2 inch preformed joint material.
- B. Water Stops: Provide water stops in construction joints and other locations as shown on Drawings and specified herein. Install water stops to form continuous diaphragm in each joint. Make provisions to support and protect water stops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions. Protect waterstop material from damage where it protrudes from joints.
1. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practical.
- C. Expansion Joints
1. Provide premolded expansion joint filler for expansion joints abutting concrete curbs (except in integral walk and curb), catch basins, manholes, inlets, structures, and other fixed objects, unless otherwise noted.
 - a. Premolded joint filler for expansion joints in exterior concrete shall be provided with a removable cap strip. Top of cap strip shall be set flush with top of finished concrete.
 2. Set and secure continuous expansion joint strips where edge of slab abuts vertical surfaces.
 3. Locate expansion joints at 30 feet o.c. for walks and curbs, unless otherwise shown.
 4. Extend joint fillers full-width and depth of joint, flush with finished surface. Furnish joint fillers in one-piece lengths for the full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together. Form top edge of filler to conform to top profile of concrete.
 5. Locate expansion joints in exterior retaining walls at 60 feet o.c. maximum.
- D. Isolation Joints in Slabs-on-Grade: 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.
 2. Install joint-filler strips in lengths as long as practical. Where more than one length is required, lace or clip sections together.
- E. Control Joints in Slabs on Grade (Ground Supported)
1. Provide control joints in slabs on grade to form panels or patterns as shown on slab plan. Use inserts 1/5 to 1/4 of slab depth, unless otherwise indicated.
 2. Form control joints by inserting premolded hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has cured for at least 7 days, remove inserts and clean groove of loose debris.
 - a. At Contractor's option, control joints may be produced by saw cuts 3/4 to 1 inch deep, using powered cutters as soon as concrete has cured sufficiently to carry the machine weight without causing surface blemishes, but not later than 12 hours after concrete is placed.
 3. Control joints shall be filled with self-leveling traffic grade sealant as specified in Division 7 - Sealants and Caulking for the following locations, unless otherwise noted:
 - a. Exposed and concealed concrete slabs on grade with no additional floor finish or sealed concrete finish only.

- 1) Sealant color shall match sealed concrete color.
 - b. Concrete slabs on grade to receive wood floor system or Contractor may omit joints in slabs under wood flooring.
 4. Locate control joints in slabs-on-ground, as shown on Drawings, if not shown, then so as to divide the slab into sections with a maximum distance of 15 feet between control joints both directions. If shrinkage reducing admixture is used in compliance with manufacturers instructions, control joint spacing may be increased to 30 feet spacing.
 5. The Contractor may elect to omit all control joints, only if specifically approved by A/E prior to construction, provided that all cracks which develop at greater than 1/64 inch width be filled with crack sealant and adhesive on or about sixty days after slab placement. Clarification: All interior slab on grade shall be reinforced with welded wire fabric and fiber reinforcement. In any event, provide control joint at corridor and at 40' C/C isolating slab within each area. Note the requirement of construction joint as specified.
- F. Control Joints in Retaining Walls
1. Locate control joints in retaining walls at 30 feet o.c. maximum. Chamfer exposed edges 3/4 inches at control joints.

3.4 FINISH OF FORMED SURFACES

- A. Rough Form Finish (RfFm-Fn): For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise shown or specified. This is the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas required and patched and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- B. Smooth Form Finish (SmFm-Fn): For formed concrete surfaces exposed-to-view or that are to be covered with a coating material applied directly to the concrete or a covering material bonded to the concrete, such as waterproofing, dampproofing, painting, or other similar system. This is the as-cast concrete surface as obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams.
- C. Grout Cleaned Finish (GrtCl-Fn): For formed concrete surfaces, which are to be coated to provide uniform color and texture, provide the following finish to surfaces specified as grout cleaned finish GrtCl-Fn in the Concrete Schedule.
1. Combine one part portland cement to 1-1/2 parts fine sand by volume, and mix with water to the consistency of thick paint. Blend standard portland cement and white portland cement, amounts determined by trial patches, so that the final color of dry grout will closely match adjacent concrete surfaces.
 2. Thoroughly wet concrete surfaces and apply grout immediately to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continuous final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise shown.

3.5 MONOLITHIC SLAB FINISHES – Field Quality Control

- A. General Information (Slabs on Grade): The requirements indicated are based upon the latest FF/FL method. Bids for this work shall reflect these requirements and enforcement thereof can be expected.

- B. Trowel Finish (Tr-Fn) - Large Rooms and Public Areas :
1. Specified Overall Value: FF 35/FL 25.
 2. Minimum Local Value: FF 24/FL 17.
 3. Apply trowel finish to monolithic slab surfaces that are to receive resilient flooring, carpet, or other thin finish system.
 4. The slab shall be steel troweled to a true level and finished smooth and straight to a tolerance of 1/8 inch in any 10 foot radius. Finish and measure surface so the gap at any point between concrete surface and an unlevelled, freestanding, 10 ft long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8" and also no more than 1/16" within 2 ft.
- C. Elevated (Mezzanine) slabs shall have a specified overall value of FF 22 to FF 27 and a minimum local of FF 20 with no FL number defined.
- D. Nonslip Broom Finish (NsBrm-Fn): Apply nonslip broom finish to exterior concrete pads, steps and ramps, and elsewhere as indicated.

3.6 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for a period of time necessary for hydration of cement and proper hardening. Provide fog spray or mono-molecular film if weather conditions could cause surface drying prior to the start of curing.
1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 72 hours.
 2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301-89 procedures. Avoid rapid drying at end of final curing period.
- B. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by membrane-forming curing, and by combinations thereof, as herein specified.
1. Provide moisture curing for not less than 7 days by following methods:
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Continuous water-fog spray.
 - c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges with 4 inch lap over adjacent absorptive covers.
 2. Provide moisture-cover curing as follows:
 - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 3. Provide membrane curing to slabs as follows:

- a. Apply membrane-forming curing compound to concrete surfaces as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by powerspray or roller in accordance with manufacturer's directions. Apply second coat to all surfaces with a direction of application at 90 degrees to the first coat and to the same rate of application. Recoat areas which are subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - b. Do not use membrane curing compounds on surfaces which are to receive concrete overlays, additional toppings, liquid floor hardener, or where incompatible with finish floor materials. Components found not to be compatible with finish floor material shall be abrasively removed by this contract, with no additional charge to Owner.
- C. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
1. Only apply where indicated on finish schedule. Do not apply to slabs to receive any other type of coating or finish.

3.7 MISCELLANEOUS CONCRETE ITEMS

- A. Concrete Sealer (Moisture Curing/Cover only)
1. Apply sealer in strict accordance with the manufacturer's written instructions. Where nonslip sealed concrete is indicated, during the application of the first coat of sealer, broadcast silica sand uniformly over wet floor surface at the rate of 4 lbs. per 100 sq.ft.; allow to dry properly, then apply second sealer coat, as approved by A/E.
 2. Before starting application, select with the A/E a location to apply a control sample 3 by 3 feet. Do not proceed until A/E approves of application rate of silica sand and finish surface.
- B. Dry Shake Hardener: After initial floating, install in strict accordance with manufacturers printed instructions and as follows:
1. Apply hardener at a minimum rate of 100 lb./100 sq.ft. by experienced workmen, unless greater amount is recommended by manufacturer.
 2. Uniform distribute approximately 2/3 of mineral dry shake materials over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second mineral dry shake application, uniformly distributing remainder of material, and embed by power floating.
 3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry shake material manufacturer and apply immediately after final finishing.
- C. Concrete Hardener: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than 7 days old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

- D. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete the work.
- E. Curbs, Steps, and Risers: Provide monolithic finish to interior curbs, steps, and risers by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- F. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as indicated. Set anchor bolts for machines and equipment to template at correct elevations, complying with certifying diagrams or templates of the manufacturer furnishing machines and equipment.
- G. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.
- H. Install rigid insulation around exterior foundation walls. The perimeter foundation insulation is applied against the inside vertical surfaces of the foundation walls and bonded with mastic except when used as protection board for waterproofing or dampproofing. Solidly fill joints with bonding mastic.
- I. Self-Leveling Underlayment: Install in strict accordance with manufacturer's written installation instructions and provide primers as recommended.
- J. Rollout Isolation Mat: Install in accordance with manufacturer's written installation instructions, details, and specifications.

3.8 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, but only when acceptable to A/E.
 - 1. Cut out honeycomb, rock pockets, voids over 1/2 inch diameter, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Before placing cement mortar, thoroughly clean, dampen with water, and brush-coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to A/E.
 - 2. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color of surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surfaces.
- B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of A/E. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by tie rods and bolts; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning.
 - 1. Repair concealed formed surfaces, where possible, that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete.

- C. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope. Tests will be performed approximately 24 hours after slab placement and again sixty days after placement. Corrective procedures will be completed for deficiencies found in both tests.
1. Repair finished unformed surfaces that contain defects, which adversely affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01 inch wide or which penetrate to reinforcement or completely through nonreinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
 2. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
 3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to A/E.
 4. Repair defective areas, except random cracks and single holes not exceeding one inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4 inch clearance. Dampen concrete surfaces in contact with patching concrete and brush with a neat cement grout coating or concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of same materials to provide concrete of the same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
 5. Repair isolated random cracks and single holes not over one inch in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and brush with neat cement grout coating. Place dry-pack before cement grout takes its initial set. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate using a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.

3.9 FIELD QUALITY CONTROL

- A. Refer to Section Division 1 - Quality Control.
- B. Concrete
1. Test Concrete in accordance with ACI 301 and as specified.
 2. Inspect placement of all reinforcement in footings prior to placement of concrete. Confirm compliance to the approved steel reinforcement drawings.
 3. During progress of work, Testing Agency shall mold cylinders and conduct compressive strength and other tests as follows:
 - a. For each strength test, prepare 4 standard cylinders in accordance with ASTM C31. Mold and store cylinders as required for laboratory cured test specimens except when field cured test specimens are required.
 - b. Make one strength test for each 50 cubic yards or fraction thereof of each class of concrete placed in any one day.
 - c. Each strength test shall have one cylinder tested at 7 days and two at 28 days and one retained at the laboratory for later testing, if required. Strength tests of high-early-strength concrete shall have cylinders tested at 3 and 7 days. Tests shall be conducted in accordance with ASTM C 39.

- d. Determine air content of normal weight concrete for each strength test. Determine air content in accordance with ASTM C231 for each 20 cubic yards of exterior concrete flat-work placed.
 - e. Check concrete for compliance with other admixture requirements of the specifications.
 - f. Perform slump tests daily in accordance with ACI 301, and on every fifth truckload. Slump tests shall always be made from the same batch from which strength tests were made.
- 4. Evaluate concrete strength tests in accordance with ACI 214 "Recommended Practice for Evaluation" of Compression Test Results of Field Concrete". Compressive strength of concrete shall conform to the following criteria:
 - a. The average of any 3 consecutive strength tests of laboratory cured specimens for each class of concrete shall exceed or equal the specified strength for that class. Not more than 10 percent of the strength tests shall have values less than the specified strength. No individual test shall have value 500 psi less than specified strength.
- 5. If compressive strength tests fail to meet the above minimum requirement, concrete represented by such tests shall be considered questionable and shall be subjected to further testing at Contractor's expense as follows
 - a. Core samples shall be secured, prepared and tested in accordance with ASTM C42.
 - b. If core tests fail to meet strength requirement or the taking of core samples is not practical, Architect shall have the authority to order load tests to be conducted and the results evaluated in accordance with ACI 318.
 - c. Failure of any portion of the structure to pass a load test will result in rejection of such portion and Contractor shall remove and reconstruct condemned areas at expense.
- C. Floor Tolerance Measurements: Floor flatness and levelness tests on floor slabs shall be conducted in accordance with the provisions set forth in ASTM E1155-87, with the exception of Subparagraphs 7.2.3 and 7.3.2 which may be waived at the Owner's option, also Zi calculation to be used shall be $N \min. = A/10$. The independent testing laboratory shall make floor tolerance measurements within 24 hours after completion of the final troweling operation, and before forms and shores have been removed, measurement shall be taken using a Dipstick Auto-Read Floor Profiler as manufactured by The Edward W. Face Company, Inc. of Norfolk, Virginia. Results of floor tolerance tests will be provided to the Contractor.
- D. Remedy for Out-Of-Tolerance Work: Slab sections measuring at or above both of the specified minimum local F-numbers shall be accepted for tolerance compliance as constructed. Floor slab sections measuring below either (or both) of the specified minimum local F-numbers shall be removed and replaced (in the case of slabs-on-grade), or ground or retopped (in the case of elevated slabs). No remedies for sub-minimum local F-number sections other than replacement of slabs-on-grade, and grinding or retopping of elevated slabs will be permitted. For the purposes of this paragraph, a floor section shall be a rectangular area bound by column or half-column lines (i.e., minimum sections area - approximately 100 sq.ft.).
 - 1. If the floor slabs, when completed, fail to meet or exceed either of the specified overall F-numbers, then the Contractor shall rebate to the Owner an amount equal to: $\$0.50 \times \text{total balance minus 10 percent of square feet measuring below specified FF or FL overall value, whichever is more for each specified finish.}$

- E. If the entire project of floor slabs, when completed, fails to meet or exceed either of the specified overall F-numbers, then the Contractor shall rebate to the Owner an amount equal to: \$0.50 x (total balance of square feet measuring below FF-36) or \$0.50 x (total balance of square feet measuring below FL-24 . . . whichever is more.

Specification Section	Material Description	Material Thickness	Slab Depression
09300	Tile Ceramic Mosaic Tile (CMT) (Thin-Set Method) Ceramic Mosaic Tile (CMT) (Mud-Set Method) Quarry Tile (QT) (Mud-Set Method) Porcelain Tile (PT) (Thin-Set Method)	1/4 inch 1/4 inch 1/2 inch 5/16 inch	1/2 inch 1-3/4 inch 2 inch 5/8 inch
*Due to product variations, depressions must be verified with proposed finish system before slabs can be poured.			

CONCRETE SCHEDULE		
ITEM OR STRUCTURE	FINISH	COMPRESSIVE STRENGTH AND OTHER REQUIREMENTS
Concrete not otherwise indicated	RfFm-Fn SmFm-Fn, if exposed	4000 P.S.I. at 28 days Max W/C Ratio = 0.45 Min Portland Cement = 470 lb/c-yd ** Mid-Range Water Reducer Required
Trench footings, footings, and interior foundation	RfFm-Fn SmFm-Fn, if exposed	4000 P.S.I. at 28 days Max W/C, Ratio = 0.50 Min Portland Cement = 470 lb/c-yd
Foundation retaining walls exposed to exterior, stem walls, piers, exterior paving	RfFm-Fn SmFm-Fn, if exposed	4000 P.S.I. at 28 days Air Entrainment = 4.5% - 7.5%* Max W/C Ratio = 0.45 Min Portland Cement = 564 lb/c-yd Mid-Range Water Reducer Required
Interior formed concrete exposed to view	SmFm-Fn	4000 P.S.I. at 28 days Max W/C Ratio = 0.50 Min Portland Cement = 470 lb/c-yd Mid-Range Water Reducer Required
Interior floor slabs	Tr-Fn	4000 P.S.I. at 28 days Max W/C Ratio = 0.45 Min Portland Cement = 500 lb/c-yd ** Mid-Range Water Reducer Required Fibrillated Polypropylene Fiber
Masonry Fill	N/A	See Division 4. For the requirements and options

Exterior walks, stoops, steps, aprons, and curbs; exterior formed concrete exposed to view; exterior concrete not otherwise indicated	NsBrm-Fn (Horizontal) Grt-Cl-Fn (Vertical)	4500 P.S.I. at 28 days Air Entrainment = 4.5% - 7.5%* Max W/C Ratio = 0.45 Min Portland Cement = 564 lb/c-yd
Stair Pan Fill Concrete topping (N/A)	NsBrm-Fn	3000 P.S.I. at 28 days Max W/C Ratio = 0.50 3/8" Max Aggregate Min Portland Cement = 500 lb/c-yd **
Exposed interior floor slabs and interior slabs scheduled to receive resilient, thin film, and wood flooring finishes	Tr-Fn	40000 P.S.I. at 28 days Max W/C Ratio = 0.45 Mid-Range Water Reducer Required Min Portland Cement = 500 lb/c-yd** Fibrillated Polypropylene Fiber
Lean concrete fill under footings and encasement of underground utilities or connections	N/A	1500 P.S.I. at 28 days Min Portland Cement=376 lb/c-yd

*Refer to Section 03 30 00 Cast-In-Place Concrete for percent of air entrainment required for concrete mix

**Refer to Section 03 20 00 – For Fibrous Reinforcing. Provide Fibrous reinforcing for these mixes.

Note: Fly ash limited 20%, except limit for lean concrete shall be 25%.

CONCRETE MIX DESIGN SUBMITTAL FORM

Project: _____

City: _____

General Contractor: _____

Concrete Contractor: _____

Concrete Strength (Class): _____

Use (describe): _____

Design Mix information:

Please Check One

Based on Standard Deviation Analysis

Trial Mix Test Data

Design Characteristics:

Density		pcf
Strength		psi (28 day)
Air		% specified

If trial mixes are used, the Mix Design is proportioned to achieve $f'_{cr} = f'_c + 1200$ psi
(1400 psi for strength higher than 5000 psi at 28 days)

MATERIALS	Type/ Source	Specific Gravity	Weight/lb.	Absolute Vol. Cu. Ft.

Cement				
Flyash				
Microsilica				
Coarse Aggregate				
Fine Aggregate				
Water				
Other				
TOTAL				

* Water/Cement Ratio (lbs. Water/lbs. Cement) = _____ %

<u>ADMIXTURES</u>	Manufacturer	Dosages oz/cwt
Water Reducer		
Air Entraining Agent		
Mid Range Water Reducer		
Fibrous Reinforcement		
Other		

Slump before HRWR _____ inches

Slump before HRWR _____ inches

Standard Deviation Analysis (from experience records):

# of Test Cylinder Evaluated:	
Standard Deviation:	

$$f_{cr} = f_c + 1.34s \text{ or } f_{cr} = f_c + 2.33s - 500$$

(Refer to ACI 301 for increased deviation factor when less than 30 tests are available)

LABORATORY TEST DATA

Compressive Strength

Age (days)	Mix #1	Mix #2	Mix #3
7	psi	psi	psi
7	psi	psi	psi
28	psi	psi	psi
28	psi	psi	psi
28 average	psi	psi	psi

REQUIRED ATTACHMENTS:

Coarse Aggregate Gradation Report

Fine Aggregate Gradation Report

Concrete Compressive Strength Data or Trial Mixture Test Data

Admixture Compatibility certification letter

Please
Check

Submitted by:

Name: _____

Address: _____

Phone #: _____

Main Plant Location: _____

Miles from Project: _____

Secondary Plant Location: _____

Miles from Project: _____

Date: _____

END OF SECTION

**SECTION 05 1200
STRUCTURAL STEEL FRAMING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.
- B. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements

1.2 SUMMARY

- A. The Work required under this Section consists of structural steel, steel erection, shop painting, field touch-up painting, and related items necessary to complete the Work indicated.
- B. Miscellaneous angles, channels, anchor bolts, bent plates, sleeves, sag rods, leveling plates, bearing plates for structural steel and steel joists, and other incidental items of structural steel required to be built into concrete or masonry shall be provided as indicated or specified and be furnished to respective trades at proper time; including instructions and templates for their installation.
- C. Provide, where specifically called for, lintels, steel shelf angles, perimeter angle closure and accessories.
- D. For openings in metal deck 12 by 12 inches inches and larger, provide steel reinforcing members on all sides of opening. Reinforcing shall be not less than 3 by 3 inches by 3/8 inch angles, unless otherwise indicated. Openings in deck shall be cut under Section 05300 - Metal Deck.
- E. Related Work Specified Elsewhere
 - 1. Division I – Quality Control
 - 2. Section 09 91 00 – Painting
 - 3. Section 03 30 00 – Cast in Place Concrete
- F. Refer to Section Division I for Alternates that may affect the Work of this Section.

1.3 SUBMITTALS

- A. Approved manufacturer's published complete product data for:
 - 1. Proposed base plate grout.
- B. Complete shop Complete shop drawings by approved fabricator including dimensioned plan layouts of columns and anchor bolt locations, dimensioned erection diagrams, and shop detail drawings. Symbols and indications used for structural components on design drawings must appear identically on submitted shop drawings. Types of electrodes proposed for welding processes must also appear thereon.

1. The fabricator must review, and check shop drawings prepared by the fabricator or the fabricators subcontractors prior to submission to the Structural Engineer (SE).
 2. AutoCAD drawings, for use in preparation of erection plans and shop drawings: Drawings may be available from the SE. The Contractors requiring this service must contact the SE to verify availability.
 3. Changes to shop drawings for resubmissions shall be "clouded" or "flagged" to clearly indicate all changes, additions, or deletions to the previous submission. Resubmissions will be reviewed only to verify those items clouded or flagged. All other information will be assumed to be unchanged from the previous submission.
- C. Letter from a Professional Engineer (PE) licensed within the state of construction activities certifying that he has carefully studied the design drawings, that shop drawings have been prepared under his direct guidance and supervision, and that provided components and connections will meet or exceed loading requirements, where loads are shown at element ends. PE's full signature and seal of authenticity must evidence such letter of certification. It should not be expected that Structural Engineer's (SE's) review of shop drawings will begin until such certification has been received. This certification is to verify the adequacy of members and connections designed by the fabricator and are not intended to require verifications of the design of structural elements shown in the plans.

1.4 QUALITY ASSURANCE

- A. Structural fasteners shall be manufactured in the United States. Fabricator shall furnish proof of U.S. manufacturer. If it becomes necessary to use imported fasteners, each size, type, and each large quantity package (500 pcs. or more) shall undergo a random sampling of a minimum 5 pieces for testing, and the test results to be provided to SE. Test shall be performed by an independent testing agency, and the cost shall be included in the Base Bid. If inferior fasteners are discovered, all fasteners of that type shall be removed and replaced with acceptable fasteners at no cost to the Owner. If possible, fasteners shall be tested prior to use in construction.
- B. Comply with the provisions of applicable building codes as well as the following specific requirements: Latest Edition:
1. AISC "Code of Standard for Steel Buildings and Bridges."
 2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" and including the "Commentary of the AISC Specification," and the current supplements.
 3. AISC "Specifications for Structural Joints using ASTM A325 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
 4. AWS "Structural Welding Code," AWS D1.1 and its latest revision.
 5. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piping, and Bars for Structural Use."
- C. Structural Steel Alignment Quality Control: Refer to Division 1 – Quality Control.
- D. See Section 3.05 – Field Quality Control for additional requirements.
- E. DELIVERY, STORAGE, AND HANDLING
- F. 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 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay work.
- C. Store materials to permit easy access for observation and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 FABRICATORS

- A. Firms acceptable as fabricators for structural steel work under this Section shall be certified in the category of "Conventional Steel Buildings (Sbd)" by the American Institute of Steel Construction. The fabricator shall cooperate with and make available to the testing agency records and documents which focus on general management, engineering and drafting, procurement, operations and quality control and shall allow access to facilities to allow the testing agency to examine actual fabrication work in the shop and drafting room at the time of the inspection. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 MATERIALS

- A. Structural Angles, Plates, and Bars: ASTM A572 Grade 50, unless otherwise noted.
- B. Rolled Steel Shapes (Wide Flanges and WT Shapes): ASTM A992 (Fy=50 ksi).
- C. Hollow Structural Sections
 - 1. Square, Rectangular, and Special Shapes: ASTM A500, Grade B (Fy=46 ksi).
 - 2. Round, Structural Steel Pipe: ASTM A53, Type E or S, Grade B or ASTM A500, Grade B (Fy=46 ksi).
- D. High Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
 - 1. Quenched and tempered medium-carbon steel bolts, nuts, and washers, complying with ASTM A325. Use 3/4 inch bolts, unless noted otherwise on the Drawings.
 - 2. Direct tension indicator washers may be used at Contractors option per ASTM F959.
- E. Electrodes for Manual Shielded and Metal-Arch Welding: AWS Code and ASTM A233, Series E60 and E70 as required.
- F. Electrodes and Flux for Submerged Arc Welding: AWS Code and ASTM A588, Series F60 and F70 as required.
- G. Structural Steel Primer Paint: Steel Structures Painting Council (SSPC) - Paint 15.

- H. Shrinkage-Resistant Grout (SR-G): CE (Corps of Engineers) CRD-C621 latest edition (formerly CRD-588) and ASTM C 1107, premixed, factory-packaged, flowable, mortar grouting compound with a minimum compressive strength of 9000 psi at 28 days. Products offered by manufacturers to comply with the requirements include the following:
 - 1. Non-Ferrous Aggregate
 - a. Five Star Fluid Grout 100; Five Star Products, Inc., Fairfield, Connecticut.
 - b. Crystex; L&M Construction Chemicals, Inc., Omaha, Nebraska.
 - c. Sure-Grip High Performance Grout; Dayton Superior Corp., Miamisburg, Ohio.
 - d. Sonnogrout 10K; Sonneborn Building Products, Shakopee, Minnesota.
 - e. Sealtight Pack-H Grout; W. R. Meadows, Inc., Hampshire, Illinois.
 - f. Enduro 50; Conspec Marketing & Manufacturing Co., Inc., Kansas City, Kansas.
- I. Masonry Bearing Plates
 - 1. All Joists shall bear on masonry bearing plates with anchor rods embedded in the masonry below. Weld joists to bearing plates in accordance with SJI Specifications. See Framing Details and Plans for bearing plate sizes.
 - 2. All beams shall bear on masonry bearing plates with anchor rods embedded in the masonry below. Weld beams to bearing plates unless otherwise noted.
 - 3. Bearing plates are to be set under the work of Division 4 – Masonry.
- J. Anchor bolts – threaded rods per ASTM A307.
- K. Adhesive Anchor Bolts
 - 1. Concrete Base Material: Refer to Section 03 20 00 - Concrete Reinforcing.
 - 2. Masonry Base Material: Refer to Section 04 05 19 - Masonry Anchorage and Reinforcing.
- L. Preformed Joint Material: Provide closed cell polyethylene expansion joint material equal to the following manufacturers:
 - 1. Sonoflex F; Sonneborn Building Products, Shakopee, Minnesota.
 - 2. Deck-O-Foam; W. R. Meadows, Inc., Hampshire, Illinois.
 - 3. Econo Foam; Williams Products, Inc., Troy, Michigan

2.3 FABRICATION

- A. General: Fabricate items of structural steel in accordance with AISC Specifications and as indicated on the final shop drawings. Provide camber in structural members as shown.
 - 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
 - 2. Where finishing is required, complete the assembly, including riveting and welding of units, before start of finishing operations.
- B. Connections.
 - 1. Weld or bolt shop connections as shown.
 - 2. Bolt field connections, except where welded connections or other connections are shown or specified.
- C. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints."
- D. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work. Assemble and weld built-up sections by methods which will produce true alignment of axis without warp
- E. Galvanizing:

1. Provide a zinc coating for those items shown or specified to be galvanized, as follows:
 - a. ASTM A123 for galvanizing rolled, pressed, and forged steel shapes, plates, bars, and strip 1/8 inch thick and heavier
 2. Lintels in exterior walls and in other walls exposed to moist environments shall be hot-dipped galvanized.
 - a. Lintels consisting of a plate and rolled beam W16 and smaller shall have both plate and beam galvanized after welding.
 - b. Lintels consisting of a plate and rolled beam larger than W16 shall have plate galvanized and beam painted a cold applied mill galvanizing.
- F. Holes for Other Work: Provide holes required for securing other work to structural steel framing, such as nailers, plates, and for the passage of other work through steel framing members, as shown on the final shop drawings. Provide threaded nuts welded to framing and other specialty items as shown to receive other

2.4 FINISHES

- A. General: Shop paint structural steel work, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on the exposed portions and the initial 2 inch of embedded areas only. Do not paint contact surfaces that are to be welded or high-strength bolted with friction-type connections. Coat with tar all steel encased in concrete and/or masonry below adjacent slab on grade.
- B. Surface Preparation: After observation and before shipping, clean steel work to be painted. Remove loose rust, mill scale, and spatter, slag or flux deposits. Clean steel in accordance with SSPC (Steel Structures Painting Council) as follows:
 1. SP-2 "Hand Tool Cleaning"
- C. Painting: immediately after surface preparation, apply structural steel rust inhibitive primer paint in accordance with the manufacturer's instructions and at a rate to provide a uniform dry film thickness of 1.5 mils. Use painting methods that will result in full coverage of joints, comers, edges, and exposed surfaces..
- D. Galvanizing: Joints between plates and beams and between intermittent welds shall be touched-up with cold applied galvanizing coating as required to insure uniform coating.
 1. Galvanized Repair Paint: High-zinc-dust-content paint for regalvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P-21 035A or 95 PC-Paint 20.

2.5 SOURCE QUALITY CONTROL

- A. The materials and workmanship to be furnished under this Specification shall be subject to observation in the mill, shop, and field by the SE. Observation will be conducted without expense to the Contractor; however, observation in the mill or shop shall not relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with contract requirements.
- B. Refer to Division 1- Quality

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erector must examine the areas and conditions under which structural steel work is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Erector.

3.2 ERECTION

- A. General: Comply with the AISC Specifications and Code of Standard Practice and with specified requirements.
- B. Surveys and Bench Marks: Establish permanent bench marks as shown and as necessary for the accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces and locations of anchor bolts and similar devices before erection work proceeds and report measurement discrepancies to the A/E. Do not proceed with erection until corrections have been made or until compensating adjustments to the structural steel work have been agreed upon with the NE.
- C. Temporary Shoring and Bracing: Provide temporary shoring and bracing members as required, with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of the structures as erection proceeds.
- D. Temporary Planking: Provide temporary planking and working platforms as required and as necessary to effectively complete the work.
- E. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place Work. Electrodes for Manual Shielded and Metal-Arch Welding: AWS Code and ASTM A233, Series E60 and E70 as required.
 - 1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
 - 2. Refer to Division 3 of these Specifications for anchor bolt installation requirements in concrete, and Division 4 for masonry installation, if required.
 - 3. Where anchor bolts are broken after installation, the concrete shall be removed around the remaining portion of the bolt in the concrete to a depth of 1/2 inch below the top of the bolt. A new segment of bolt of the same steel strength shall be full penetration welded to the remaining bolt in the concrete. The new segment of bolt shall be tapered on the welded end to a 30 degree bevel all around to leave a thickness at the beveled end of 1/4 inch.
 - 4. Where anchor bolts are incorrectly located in the concrete or masonry which encases them, the following procedures shall be used
 - a. For bolt misalignment less than 5/16 inch: offset the column with base plate as required to locate column correctly. The 5/16 inch oversized holes in the column base plates will allow this movement without modification to the column or the anchor bolts.
 - b. For bolt misalignment more than 5/16 inch and less than 2 inches: cut and remove base plate from column, relocate base plate and reweld to column.
 - c. For bolt misalignment more than 2 inch and less than 6 inches: cut off anchor bolts flush with surface of concrete or masonry and install adhesive anchor bolts as specified in Division 4 for masonry and Division 3 for concrete base material.

- F. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean the bottom surface of base and bearing plates.
 - 1. Setting Plate Procedure
 - a. Set loose and attached base plates and bearing plates for structural members on wedges or other adjustable devices.
 - b. Tighten the anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but, if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.
 - c. Pack bedding grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow curing in strict compliance with the manufacturers instructions, or as otherwise required.
- G. Field Assembly: Set structural frames accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of the structure within specified AISC tolerances.
 - 2. Splice members only where shown or specified, unless approved otherwise by the A/E or his representative.
- H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces
- I. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and the removal of paint on surfaces adjacent to field welds.
 - 1. Do not enlarge unfair holes in members by burning or by the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- J. Gas Cutting: Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing.
- K. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint. Apply paint to exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.
- L. Lintels and Shelf Angles: Weld or bolt members together where so indicated.
 - 1. Lintels shall have 8 inch bearing at each end, minimum, unless shown otherwise. Bearing pressures shall not exceed the allowable stress for masonry
 - 2. Where shelf angles are attached to concrete with bolts and adjustable inserts, provide slotted holes of proper size and spacing in the vertical leg of shelf angles.

3.3 HIGH STRENGTH BOLTS

- A. Structural joints using high strength bolts, hardened washers, and nuts shall be tightened to a high tension; the materials, methods of installation and tension control, type of wrenches to be used, and observation methods shall conform to specifications for "Structural Joints using ASTM A325 or A490 Bolts," as approved by the Research Council on Structural Connections of the Engineering Foundation, Latest Edition
- B. The high strength bolts used shall have a suitable identifying mark placed on top of the head before leaving the factory.

- C. All high strength bolted connections shall be “snug-tight” connections, unless otherwise indicated on the Drawings.
 - 1. “Snug-tight” is defined as the tightness that exists when all plies in a joint are in firm contact and can be attained with a few impacts of an impact wrench or by the full effort of a person using an ordinary spud wrench
- D. Where specifically noted on the Drawings, bolted connections shall be installed “slip-critical”.
 - 1. Tightening of nuts shall be done by the turn-of-nut method, according to the Specifications for Structural Joints” using ASTM A325 or A490 bolts,” endorsed by AISC, unless direct tension indicator washers are used, in which case tightening will terminate when the proper gap is attained.
 - 2. For the “turn-of-nut” method, bolts that have been “snug-tight” shall be marked on both the bolt head and the nut with an identifying symbol, and then given an additional fraction of a turn as specified in Table 5 of the above referenced specification. Marks shall be such that visual observation can be made of finished connections. Snug-tight is defined as the tightness developed by the full effort of a man using a spud wrench on all bolts in the connections.
 - 3. Slotted holes will be allowed in following locations, only and shall have snug tight bolted connections
 - a. The outstanding legs of angles used in beam shear splices
 - b. Hip and valley beams where both ends frame into steel members in an all steel frame.
 - c. Diagonal or skewed beams where both ends frame into steel members in an all steel frame.
 - d. Other connections where specifically detailed in the drawings.
 - e. All of other holes shall be standard bolt (1/16 inch larger than bolt).

3.4 ERECTION ALIGNMENT

- A. Framing: The framing shall be carried up true, plumb, and level within a tolerance of 1:500; and temporary bracing shall be introduced, wherever necessary, to take care of loads to which the structure may be subjected, including erection equipment and its operation. Such bracing shall be left in place as long as may be required for safety. The Contractor as part of his equipment shall finally remove it. As erection progresses, the Work shall be securely connected to take care of dead load, wind, and erection stresses.

3.5 FIELD QUALITY CONTROL

- A. **Contractor shall retain an independent testing agency to check connection and (Note retained by contractor of owner) fastening as specified herein. Conform to Division One — Quality Control.**
- B. Steel (includes work for metal joists and metal deck).
- C. Structural Steel
 - 1. The Testing Agency shall conduct and interpret tests and state in each report whether test specimens comply with the requirements, and specifically state any deviations from requirements.
 - a. Contractor shall provide access for the Testing Agency to places where structural steel is being fabricated or produced so inspection and testing can be accomplished.
 - 2. Bolted Connections: Inspection in accordance with AISC Specification for Structural Joints, as follows:

- a. Visually inspect all bolts.
 - b. Check for proper torque with a calibrated torque wrench. Minimum two bolts of alternate design connections between beams and girders. Minimum two bolts of every connection between girders and columns.
 - c. All bolted connections that fail shall be corrected and all bolts in that connection shall be retested. The cost of retests on connections that fail shall be borne by the contractor.
3. Field During erection of structural steel, inspect and test assemblies in accordance with AWS Structural Welding Code and as follows:
- a. Perform visual inspection of all welds and test those which are questionable.
 - b. Perform non-destructive tests of weld as required above, as follows:
 - 1) Fillet Welds: One spot test per member. Magnetic particle testing may be used.
 - 2) Partial Penetration Welds: One spot test per weld using ultrasonic testing techniques.
 - 3) Full Penetration Welds: One spot test per weld for shop welds and the entire length of all field welds. Use radiographic or ultrasonic testing techniques.
 - c. Ultrasonic inspection shall be performed on all welds subject to tension in moment connections. See drawings for locations. In addition, any other welds in question or selected at random by the inspector or Structural Engineer shall be tested by this method. When ultrasonic inspection is used, 100 percent of the length of the weld shall be inspected. Any retesting required shall be paid for by the Contractor responsible for work being tested.
 - d. Re-inspect and retest defective welds which have been re-welded. The cost of re-welding, re-inspection and retesting shall be paid by the Contractor.

END OF SECTION

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**SECTION 05 2100
STEEL JOIST FRAMING**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.
- B. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements

1.2 SUMMARY

- A. The Work required under this Section consists of steel joists, steel truss accessories, and related items necessary to complete the Work indicated.
- B. When outriggers, angles, or other components are attached to the open web steel joists in the shop, in such a way that they are a component part of the joists, they are to be provided under this Section.
- C. The Work includes bridging and bridging anchors, sag rods, wall anchors, and beam anchors.
- D. Related Work Specified Elsewhere
 - 1. Section 051200 — Structural Steel Framing: For field welding quality control.
 - 2. Ends of joists resting on masonry require steel bearing plates furnished under Section 051200 - Structural Steel Framing and installed under Division 4 Masonry over a leveling bed of mortar.
- E. Refer to Section 012300 for Alternates that may affect the Work of this Section.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads within limits and under conditions indicated.
- B. Design joists to withstand design loads with total load deflections no greater than the following:
 - 1. Roof Joists: Vertical deflection of 1/240 of the span, max 1.5" unless approved otherwise.

1.4 SUBMITTALS

- A. Shop Drawings by Approved Fabricator: Include plan layouts of joists, joist girders, and special joist locations, loading diagrams, and shop detail drawings. Symbols and indications used for structural components on design drawings must appear identically on submitted shop drawings. Types of electrodes proposed for welding processes shall also appear thereon.
 - 1. Indicate locations and details of anchorage devices and bearing plates to be embedded in other construction.
 - 2. Comprehensive engineering analysis certified by the qualified professional engineer responsible for its preparation.

- B. Certification Letter: Professional Engineer licensed within the state of construction activities certifying that has carefully studied the design drawings, that shop drawings have been prepared it under his direct guidance and supervision, and that provided components and connections will meet or exceed loading requirements. Such letter of certification shall be evidenced by A/E's full signature and seal of authenticity. A/E's review of shop drawings will not begin until such certification has been received.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.
- D. Manufacturer Certificate: Signed by joist manufacturer certifying that products furnished comply with SJI standard specifications and is certified by SJI to manufacturer joists.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing joists similar to those indicated for this Project and with a record of successful in-service performance.
 - 1. Manufacturer must be certified by SJI to manufacturer joists similar to those indicated for this Project and with a record of successful in-service performance.
 - 2. Assumes responsibility for engineering special joists to comply with performance requirements. This responsibility includes preparation of shop drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 3. Professional Engineer Qualifications: A professional engineer who is legally authorized 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 installation of joists that are similar to those indicated for this Project in material, storage, and extent.
- B. Provide joists fabricated in compliance with the following and as herein specified.
 - 1. SJI "Standard Specifications and Load Tables" for KCS, LH, and DLH Series Open Web Steel Joists, latest edition, sizes as indicated on the Drawings.
 - 2. Customized joists / truss profile as indicated. Special top chord, bottom chord profile as shown.
- C. Qualification of Field Welding Work
 - 1. Qualify welding processes and welding operators in accordance with the AWS DI .1, "Structural Welding Code-Steel" and AWS DI .3, "Structural Welding Code—Sheet Steel". Welders shall be certified to perform the type of work required.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel joists as recommended in SJI and AISC "Standard Specifications," in a manner to avoid excessive stresses or deforming of members. Joists shall be supported on timbers such that no part of the joist touches the ground. Timbers shall be located under joist panel points.
- B. Bent or damaged joist members shall be cause for joist rejection. Rejected joists shall be repaired or replaced within 10 working days of notification.
- C. Joists shall be lifted from trucks to the storage timbers with a crane or other lifting device. Joists shall not be dropped or slid off of trucks to the ground.

1.7 PROJECT CONDITIONS

- A. During the construction period, Contractors shall provide means for the adequate distribution of concentrated loads so that the carrying capacity of any joist is not exceeded.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Steel: Comply with SJI and AISC "Standard Specifications."
 - 1. Yield strength used as a basis for the design stresses shall be as follows:
 - a. Chords = 50,000 psi
 - b. Webs = 36,000psi or 50,000psi
 - 2. Evidence that the steel furnished meets or exceeds the design yield strength shall be provided, on A/E's request, in the form of certified test reports.
 - 3. Deduct the area of holes in chords from the area of the chord when calculating the strength of the member.
 - 4. Bolts: Carbon or high-strength carbon steel

2.2 FABRICATION

- A. General: Fabricate steel joists in accordance with SJI and AISC "Standard Specifications," and as follows:
 - 1. Shop connections and splices shall be welded with either arc or resistance welding. Shop-bolted connections are not acceptable. Field bolted splices are acceptable where shown on the Drawings.
 - 2. Top and bottom chords shall be of uniform size throughout their full length.
- B. Top Chords: Shall be absolutely flat across its full width and length for application of metal decking.
- C. Bottom Chords: Shall be extended and connected to columns or webs of girders at column lines and where shown on structural drawings.
- D. Joist Ends: Shall be beveled when slope exceeds 1/4 inch in 12 inch or sloped shoes shall be provided.
- E. Extended Ends, Headers, and Ceiling Extensions: Shall be provided where indicated on the Drawings, in conformance with manufacturer's standards and applicable SJI and AISC "Standard Specifications."
- F. Camber joists according to SJI's "Specifications", unless otherwise noted.
- G. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- H. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joint, chord size, spacing, and span. Note additional bridging requirements indicated on the drawing.
- I. Provide additional bridging (diagonal or horizontal) at next to the last bay.

2.3 FINISHES

- A. Remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories before application of shop paint.
 - 1. Shop painting shall comply with Federal Specification preparation requirement #TTP636.
- B. Paint: Comply with SJI and AISC "Standard Specifications," except asphalt type paint is not permitted. Provide Type 1, red oxide, steel joist shop paint conforming to Steel Structure Painting Council (SSPC) - Paint 15.
- C. Apply one shop coat of steel joist primer paint to steel joists and accessories by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 1.0 mil.

PART 3 EXECUTIONS

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Roof joist anchorage shall be designed to resist net uplift force as indicated.
- B. Joist anchorage for unenclosed areas and roof overhangs shall be designed to the upward pressure indicated on the Drawings, or as per OBC, whichever is stricter.

3.3 INSTALLATION

- A. General: Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 - 4. Delay rigidly connecting bottom chord extensions to columns or supports until dead loads have been applied.
- B. Spacing: Set joists at specified slope and to spacing shown with the specified end bearing at supports. Check alignment, plumbness and uninterrupted slopes prior to the installation of the deck.
- C. End Anchorage
 - 1. At steel supports the joist ends shall extend not less than 2-1/2 inches over beams, or as specified in the SJI "Standard Specifications."
 - 2. At masonry the joist ends shall extend not less than 4 inches over walls, or as specified in the SJI "Standard Specifications." The center line of bearing of the joist shall coincide with the center line of the masonry bearing plate and the masonry wythe on which it bears, except where 2 joists from opposite sides bear

- 3. on the same wythe.
Ends shall be anchored as specified in the SJI "Standard Specifications."
- D. Bridging: Shall be installed prior to release of hoisting cable.
 - 1. Do not hang piping, ducts, or other equipment from bridging.
- E. Anchors: Bridging shall extend to walls or beams and shall be anchored thereto before construction loads are placed on the joists. Bridging connections to masonry wall shall be with adhesive anchors as specified in Division 4. Mechanical or wedge type anchor shall not be used.
- F. Field Welding
 - 1. The total length of weld at a cross-section shall not exceed 50 percent of the overall developed width of cold-formed members.
 - 2. Extreme caution shall be exercised during welding. Completely cover and protect masonry and concrete in place from damage during welding.
 - 3. Field welds will be visually inspected according to AWS DI. 1. and in accordance with specification Section 05 1000.
- G. Touch-Up Painting
 - 1. After joist installation, paint field bolt heads and nuts and abraded or rusty surfaces on joists and steel supporting members. Wire brush surfaces and clean with solvent before painting. Use the same type of paint as used for shop painting.
- H. Support of Other Work
 - 1. Suspension wires, straps, chains, etc. used to support lights, ceiling grid, ductwork piping conduit, etc. shall be hung from top or bottom chord panel points.

END OF SECTION

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**SECTION 05 3100
STEEL DECKING**

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. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.2 SUMMARY

- A. The Work of this Section consists of providing all metal decking and related items necessary to complete the Work indicated.:
 - 1. Metal Roof Deck units.
- B. Related Requirements:
 - 1. Section 05 1200 "Structural Steel Framing" for shop priming structural steel.
 - 2. Section 05 2100 "Steel Joist Framing" for shop priming metal fabrications.
 - 3. The cutting, drilling, or punching of openings smaller than 12 by 12 inches for passage of pipes, ducts, and the attachment of other items shall be performed in the field by the respective trades requiring same.
 - 4. For openings 12 by 12 inches and larger, each shall be predetermined and provided or cut under this Section. Steel framing members indicated or required around openings 12 by 12 inches and larger through decks shall be provided and erected under Section 051200.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements.
 - 1. Compute the properties of metal roof deck sections on the basis of the effective design width as limited by the provisions of the SDI specifications. Provide the deck section properties, including section modulus and moment of inertia per foot of width..
 - 2. Allowable Deflection: Design and fabricate deck for a maximum deflection of 1/240 of the clear span under the uniform live load.

1.4 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product specified.
- B. Shop Drawings: Show layout of deck panels, anchorage details, and every condition requiring closure panels, supplementary framing, special jointing, or other accessories.
- C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.

1.5 QUALITY ASSURANCE

- A. Qualification of Welding Work
 - 1. Quality welding processes and welding operators in accordance with the AWS "Standard Qualification Procedure."
 - 2. Decking welded place is subject to inspection and testing. Remove and replace work found to be defective and not complying with requirements.
- B. Codes and Standards
 - 1. Comply with the provisions of the following codes and standards, except as otherwise shown or specified:
 - 2. AISI "Specification for the Design of Cold-Formed Steel Structural Members"
 - 3. AWS "Structural Welding Code," AWS D1.1
 - 4. SDI "Steel Roof Deck Design Manual"
 - 5. Comply with Factory Mutual requirements, Class I fire rating and Class I-90 windstorm ratings.
 - 6. Conform to testing as per Section 05 10 00 – Structural Metal Framing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. 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 MANUFACTURER

- A. Products of the following manufacturers will be considered, providing their products equal or exceed the quality specified; and they can provide products of the type, size, function, and arrangement required:
 - 1. Wheeling Steel Corporation, Wheeling, West Virginia
 - 2. Vulcraft/Div. Nucor Corp., St. Joe, Indiana
 - 3. United Steel Deck, Inc., Summit, New Jersey
 - 4. Consolidated Systems, Inc., Columbia South Carolina
 - 5. Epic Metals Corporation, Rankin, Pennsylvania
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/Es approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
 - 1. Refer to Division 1 – Instruction to Bidders and Section 01 33 00 – Substitution Request Form for additional requirements.

2.2 MATERIALS

- A. Steel for Galvanized Deck: ASTM A653, Structural Quality Grade 33 or higher, G60 Zinc Coating
- B. Miscellaneous Steel Shapes: ASTM A36
- C. Galvanizing for Roof Decks and Metal Accessories: ASTM A525, G60 (.60 oz. per sq.ft.).
- D. Galvanizing Repair Paint: SSPC Paint 20 or DOD-P-21 035, with dry film containing a minimum of 94 percent zinc dust by weight.
- E. Flexible Closure Strips: Manufacturers standard vulcanized, closed-cell, synthetic rubber.
- F. Acoustic Sound Barrier Closures: Manufacturers standard mineral fiber closures.
- G. Self-Drilling Screws: No. 10 self-drilling screws by Hilti or ITW Buildex with lengths adequate for thickness of base material.
- H. Powder Actuated Fasteners: Hilti ENP2 or X-EDNI9/X-EDNK22/ENP2K pins, ITW Buildex BX14 fasteners, Pneutek SDK-series, or proposed equal
- I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick with factory punched hole of 3/8 inch minimum diameter.

2.3 FABRICATION

- A. General: Form deck units in lengths to span 3 or more support spacings, with flush, telescoped or nested 2 inch end laps and nesting side laps, unless otherwise shown or specified. Provide deck configurations complying with SDI "Basic Design Specification" and as specified herein.
- B. Metal Roof Deck Units
 - 1. For all roof slopes, provide galvanized Type WR (1-1/2 inches deep) or 3" inches deep as specified by the Steel Deck Institute. Depth and gauge shall be as indicated on the Drawings.
- C. Metal Cover Plates: Fabricate metal cover plates for end-abutting floor deck units of galvanized sheet steel not less than same thickness as decking. Form to match contour of deck units and approximately 6 inches wide.
- D. Ridge and Valley Plates: Fabricate ridge and valley plates of galvanized sheet steel of the same quality as the deck units; not less than 6 inches wide, bent to provide tight fitting closure with deck units. Provide plates in 10 foot lengths where possible.
- E. Metal Closure Strips: Fabricate metal closure strips of galvanized sheet steel of the same quality and gauge as the deck units; except not less than 18 gauge. Form to the configuration required to provide tight fitting closures at open ends and sides of decking.
- F. Roof Sump Pans: Shall be fabricated from a single piece of galvanized sheet steel of the same quality as the deck steel and shall be of not less than 0.0747 inch thick before galvanizing.
 - 1. Pans shall have an overall dimension of not less than 29 by 33 inches. Pans shall have a recessed surface of not less than 1-1/2 inch to receive roof sump.
 - 2. Bearing flanges for metal deck shall be not less than 3 inches wide.
 - 3. Pans shall be formed to provide flat (level) sump surface in relationship to the roof slope.

- a. Accessories: Provide closure plate, pour stop, edge strip, and other accessories required for complete installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Installer must examine the areas and conditions under which metal roof decking items are to be installed. Notify the NE in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- B. Install deck panels and accessories according applicable specifications and commentary of SDI Publication No. 29, manufacturer's recommendations, and requirements of this Section.

3.2 INSTALLATION

- A. General Install roof and floor deck units and accessories in accordance with manufacturers' recommendations and final shop drawings and as specified herein
- B. Placing Roof Deck Units
 1. Do not start placement of roof deck units before supporting members are installed. Place deck units on the supporting steel framework and adjust to final position with ends bearing on supporting members and accurately aligned end to end before being permanently fastened.
 - a. Lap ends of 1-1/2 inch roof deck and noncomposite floor deck units not less than 2 inches centered over supports.
 - b. Butt ends of 3 inch deck units over supports.
 - c. Do not stretch or compress the side-lap interlocks.
 - d. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
 2. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
 3. Do not use deck units for storage or working platforms until permanently secured in position.
- C. Fastening Roof Deck Units
 1. To structural steel supporting members:
 - a. Permanently fasten roof deck units to steel supporting members by not less than 5/8 inch diameter puddle weld at a 36/5 pattern. Along boundaries and ends of decks space welds at 6" on center.
 - b. Comply with AWS requirements and procedures for manual shielded metal-arc welding, the appearance and quality of welds, and the methods used in correcting welding work.
 - c. Lock side laps between adjacent deck units with No. 10 self-tapping screws at intervals not exceeding 24 inches o.c., unless otherwise noted.
 2. Pneumatic fasteners may be submitted as an alternative for approval by Engineer of Record and Deck Supplier.
 - a. Acceptable manufacturer's: Hilti Inc
- D. Cut and Fitting.

1. Cut and fit roof deck units and accessories around other work projecting through or adjacent to the decking. Provide neat, square and trim cuts.
- E. Reinforcement at Openings
 1. Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work, unless otherwise shown.
 2. Reinforce roof and floor decking around openings less than 12 inches in any dimension by means of a flat steel sheet placed over the opening and fusion welded to the top surface of the deck. Provide steel sheet of the same quality as the deck units, not less than 20 gauge and at least 12 inches wider and longer than the opening. Provide welds at each corner and spaced not more than 12 inches o.c. along each side
- F. Roof Sump Pans
 1. Place roof sump pans over openings provided in the roof decking and weld to the top decking surface. Space welds not more than 12 inches o.c. with at least one weld in each corner and at center along perimeter. Cut opening in the bottom of the sump to accommodate the drain size indicated.
- G. Ridge and Valley Plates
 1. Weld ridge and valley plates to the top surface of the roof decking. Lap end joints not less than 3 inches, with laps made in the direction of water flow. Minimum gauge shall be 14.
- H. Closure Strips
 1. Provide metal closure strips at open uncovered ends and edges of roof decking and in the voids between decking and other construction. Weld into position to provide a complete decking installation.
 2. Provide metal joint covers at abutting ends and changes in direction of floor deck units, except where taped joints are required.
 3. Provide flexible closure strips instead of metal closures, at Contractors option, wherever their use will ensure complete closure. Install with adhesive in accordance with manufacturers instructions.
- I. Touch-Up Painting – Galvanized Deck
 1. After roof decking and metal accessory installation, wire brush, clean, and paint scarred areas, welds, and rust spots on the top and bottom surfaces of decking units, and supporting steel members with galvanizing repair paint, applied in accordance with manufacturer's instructions and ASTM A780.
- J. Repair of Blow Holes in Deck
 1. Holes up to 1 1/2 inch in diameter, fill with urethane or silicone sealant and cover with duct tape.
 2. Holes above 1/2 inch diameter require sheet metal plate patches fastened to deck.
- K. Support of Other Work
 1. Suspension wires, straps, and chains such as those used to support acoustical ceilings, ductwork, and lights shall not be attached to or through steel roof decks.

END OF SECTION

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**SECTION 05 4000
COLD-FORMED METAL FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Load-bearing wall framing.
- B. Interior and Exterior non-load bearing wall studs and framing.
- C. Related accessories and necessary fasteners to complete the system.
- D. Diagonal Strap Bracing

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 06 1000 - Rough Carpentry: Wood blocking and miscellaneous framing.
- C. Section 06 1000 - Rough Carpentry: Wall sheathing - composite continuous insulation and plywood wall panels.
- D. Section 07 2100 - Thermal Insulation: Insulation within framing members.
- E. Section 09 2216 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).
- B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- F. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.
- G. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
- H. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.
- I. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).
- J. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).
- K. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with work of other sections that is to be installed in or adjacent to metal framing systems, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on cold-formed steel structural members; include material descriptions and base steel thickness.
- C. Product Data: Provide manufacturer's data on factory-made connectors and mechanical fasteners, showing compliance with requirements.
- D. Product Data: For lateral-force resisting systems, provide product data sheets on hold-down, showing compliance with requirements.
- E. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
 - 1. Indicate stud and ceiling joist layout.
 - 2. Describe method for securing studs to tracks and for bolted framing connections.
- F. Design Data (Delegated Design Submittal):
 - 1. Shop drawings signed and sealed by a professional structural engineer registered in the State of Ohio.
 - 2. Design calculations sufficient to demonstrate compliance with design criteria; signed and sealed by a professional structural engineer.
 - 3. Details and calculations for factory-made connectors, signed and sealed by a professional structural engineer.
- G. Installation Drawings: Indicate dimensioned locations of cold-formed steel structural framing.
- H. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before the start of scheduled welding work.
- I. Testing Agency Qualification statement.

1.06 QUALITY ASSURANCE

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Designer Qualifications: Design framing system under direct supervision of a professional structural engineer experienced in designing this work and licensed in the State in which the Project is located.
- C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Structural Framing:
 - 1. ClarkDietrich
 - 2. MarinoWARE
 - 3. The Steel Network, Inc
- B. Connectors:

1. Same manufacturer as metal framing.

2.02 PERFORMANCE REQUIREMENTS

- A. Comply with requirements for Contractor's design-related professional design services indicated in Section 01 4000 - Quality Requirements.
- B. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI S240.
- C. Design Loads: Occupancy Live, Roof Live, Snow, Wind, and Seismic loads shall be as indicated in the General Structural Notes on the Structural Drawings.
 1. Exterior wall framing horizontal deflection where "L" is the stud height:
 - a. Supporting flexible finishes: L/240
 - b. Supporting Portland Cement-based Plaster (Stucco): L/360
 - c. Supporting masonry, brick, or stone finishes: the more stringent of L/600 or 3/8".
 - d. Supporting extremely brittle finishes: L/720 or as defined by finish manufacturer.
 2. Interior wall framing horizontal deflection where "L" is the stud height and the applied horizontal live load is 5 psf (ASD) loading:
 - a. Supporting flexible finishes: L/240.
 - b. Supporting brittle finishes: L/360.
 3. Ceiling and soffit joist framing vertical deflection where "L" is the horizontal span of the joist:
 - a. Vertical Live Load deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.

2.03 MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.
 1. Structural Grade: As required to meet design criteria.
 2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

2.04 STRUCTURAL FRAMING COMPONENTS

- A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.
 1. Structural Grade: As required to meet design criteria.
 2. Thickness and Depth: Depth as indicated on the drawings; thickness and structural grade as required to meet design criteria.

2.05 LATERAL FORCE-RESISTING SYSTEMS

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.
 1. Structural Grade: As required to meet design criteria.
 2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

2.06 CONNECTIONS

- A. Performance Requirements: Provide connections in compliance with requirements of AISI S240.
- B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.
 1. Structural Grade: As required to meet design criteria.
 2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.
- C. Structural Performance: Maintain load and movement capacity required by applicable building code and specified design criteria.

- D. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
- E. Fixed Connections: Provide nonmovement devices for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.
- F. Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connectors where indicated on the drawings.

2.07 MISCELLANEOUS CONNECTIONS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized per ASTM A153/A153M.

2.08 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION - GENERAL

- A. Install structural members and connections in compliance with ASTM C1007.

3.03 INSTALLATION OF STUDS

- A. Install wall studs plumb and level.
- B. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
- C. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.
- D. Install load-bearing studs; brace, and reinforce to develop full strength and achieve design requirements.
- E. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- F. Install intermediate studs above and below openings to align with wall stud spacing.
- G. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.
- H. Attach cross studs to studs for attachment of fixtures anchored to walls.
- I. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- J. Touch-up field welds and damaged corrosion-protected surfaces zinc-rich paint in compliance with ASTM A780/A780M.
- K. Touch-up field welds and damaged corrosion protected surfaces with primer.

3.04 TOLERANCES

- A. Studs - Vertical Alignment (Plumbness): 1/960 of span or 1/8 inch in 10 ft (3.2 mm in 3000 mm), in accordance with ASTM C1007.
- B. Studs - Maximum Variation from True Position: 1/8 inch (3.2 mm) in accordance with ASTM C1007.
- C. Stud Spacing: 1/8 inch (3.2 mm) from the designated spacing, provided that the cumulative error does not exceed the requirements of the finishing materials in accordance with ASTM C1007.

END OF SECTION

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**SECTION 05 5000
METAL FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items. Supports for equipment (Chiller) enclosure.
- B. Downspout boots.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 09 9113 - Exterior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
- G. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- I. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

- E. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

- A. Steel frames and support of screening for equipment enclosure: Galvanized finish.

2.04 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.05 DOWNSPOUT BOOTS

- A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots and on-body cleanout and cover with neoprene gaskets.
 - 1. Configuration: Angular.
 - 2. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (9.5 mm), minimum.
 - 3. Finish: Manufacturer's standard factory applied powder coat finish.
 - 4. Color: To be selected by Architect from manufacturer's standard range.
 - 5. Manufacturers:
 - a. Downspoutboots.com, a division of J. R. Hoe & Sons.
 - b. Neenah Foundry Company, or approved equal.

2.06 FINISHES - STEEL

- A. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating. (Provide minimum 530 g/sq m galvanized coating.)
- B. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.07 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

- B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
- D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Obtain approval prior to site cutting or making adjustments not scheduled.
- D. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- E. Install miscellaneous framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- F. Installation of metal downspout boots - Anchor metal downspout boots to concrete or masonry construction to comply with manufacturer's written instructions.
 - 1. Secure downspouts terminations to downspouts and substrate per manufacturer's instructions.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

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**SECTION 05 5213
PIPE AND TUBE RAILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Free-standing railings at steps and ramps.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 09 9113 - Exterior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. AISC 207 - Standard for Certification Programs; 2023.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- E. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.
- F. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2024.
- G. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Include the design engineer's seal and signature on each sheet of shop drawings.

1.05 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
- B. Fabricator Qualifications:
 - 1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 207.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

- B. Comply with ASTM E985.
- C. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 50 pounds per linear foot (730 N/m) applied to the top of the assembly and in any direction, without damage or permanent set.
- D. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds (890 N) applied at any point on the top of the assembly and in any direction, without damage or permanent set.
- E. Distributed and concentrated loads need not be assumed to act concurrently.
- F. Allow for expansion and contraction of members and building movement without damage to connections or members.
- G. Dimensions: See drawings for configurations and heights.
- H. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
- I. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

- A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.
- C. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.
- D. Exposed Fasteners: No exposed bolts or screws.

2.03 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- D. Welded Joints:
 - 1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 - 2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
 - 3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.

- B. Supply items required to be cast into concrete with setting templates, for installation as work of other sections.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.

END OF SECTION

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**SECTION 06 1000
ROUGH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall Sheathing.
- B. Composite continuous insulation and plywood wall panels with integral weather resistive barrier.
- C. Wall Sheathing with integral air/water resistive barrier.
- D. Preservative treated wood materials.
- E. Fire retardant treated wood materials.
- F. Miscellaneous framing and sheathing.
- G. Concealed wood blocking, nailers, and supports.
- H. Plywood backing panels.
- I. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 07 2600 - Vapor Retarders: Vapor barrier for exterior walls.
- C. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).
- C. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).
- D. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- F. AWPA U1 - Use Category System: User Specification for Treated Wood; 2024.
- G. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. PS 2 - Performance Standard for Wood Structural Panels; 2018.
- I. PS 20 - American Softwood Lumber Standard; 2025.
- J. SPIB (GR) - Standard Grading Rules; 2021.
- K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.

- B. Product Data: Provide technical data on wood preservative materials.
- C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.
- D. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- E. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.
- F. Fastening Guidelines for Composite insulation and plywood panel: Manufacturer's 3rd party engineering evaluations for attachment of Xci Ply, including:
 - 1. DrJ TER 2102-05: For all non-structural applications of Xci Ply to wood and steel studs, concrete, and CMU.

1.05 QUALITY ASSURANCE

- A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP).
 - 1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
 - 2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings.
- C. Moisture Content: S-dry or MC19.

2.03 CONSTRUCTION PANELS

- A. Wall Sheathing (new additions exterior walls): Composite continuous insulation and plywood wall panels: Polyisocyanurate insulation bounded to fire treated plywood
 - 1. Basis of Design: Xci Ply by Hunter Panels, or approved equal.
 - 2. Board Insulation: Closed cell polyisocyanurate foam core bonded to a premium performance coated glass facer on one side fire treated plywood

- a. Foam core: Grade 2 (20 psi)
3. Fire Treated Plywood Thickness: 5/8 inch.
4. Panel Size: 4 feet by 8 feet (1220 mm by 2440 mm).
5. Thickness / R Value: based on ASTM C 518 at 75 degrees F (23.9 degrees C):
 - a. 2.6 inches (66 mm) / R Value 12.9 with 5/8 inch plywood facing
6. Weather Resistive Barrier (WRB)" Vapor permeable barrier recommended for exterior of Xci Ply panels (10-60 perms)
 - a. Xci VP-SA-WRB, vapor permeable air and water resistive barrier by Hunter Panels.
7. Liquid Joint Sealant:
 - a. Xci BarriBond XL
8. Panel Fasteners: Fasteners shall be approved Hunter Panels fasteners. Fasteners are a corrosion resistant type with oversized heads. Length of fasteners shall be as recommended by the panel manufacturer.
 - a. Hunter SIP/HD and SIP/HD-PT (Partial Thread): 12-16 gauge steel studs
 - b. Engineering Evaluations for fastening patterns (DrJ 1202-01 or DrJ TER 1508-01).
- B. Wall Sheathing: (new exterior curved wall at existing building) Glass mat faced gypsum with integral water-resistive and air barrier, ASTM C1177/C1177M, Type X 5/8 inch (15.9 mm) thick.
 1. Edges: Square.
 2. Water Vapor Permeance: 30 perms (1723.5 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M.
 3. Air Permeance, Sheathing: 0.001 cfm/sq ft (0.005 L/s per sq m), maximum, when tested in accordance with ASTM E2178.
 4. Sheathing 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.
 5. Fire Propagation Characteristics: Complies with NFPA 285 testing as part of an approved assembly.
 6. Fluid-Applied Flashing: Approved by sheathing manufacturer.
 7. Warranty:
 - a. Exposure: Manufacturer's standard; 12 months, against exposure damage, and dated from installation of product.
 - b. Defect: Manufacturer's standard; 5 years, against manufacturing defects, and dated from purchase of product.
 - c. Material: Manufacturer's standard; 5 years, dated from Date of Substantial Completion.
 8. Products:
 - a. Georgia-Pacific LLC; DensElement Barrier System: Basis-of-Design, or approved equal.
- C. Wall Sheathing, (parapet walls, inside face): Wood structural panels with noncombustible overlayment or coating factory-bonded to interior face of plywood panels.
 1. Overlayment Noncombustibility Testing: Comply with ICC (IBC) testing requirements.
 2. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84 or UL 723.
 3. Plywood Panels:
 - a. Comply with PS 2.
 - b. Performance Category and Span Rating: 15/32 PERF CAT and 32/16 span rating.
 - c. Bond Classification: Exposure 1.

2.04 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.05 ACCESSORIES

- A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
- B. General Purpose Construction Adhesives: Comply with ASTM C557.

2.06 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWP A U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWP A standards.
- B. Fire Retardant Treatment:
 1. Exterior Type: AWP A U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat exterior rough carpentry items.
 - c. Do not use treated wood in direct contact with the ground.
 2. Interior Type A: AWP A U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat rough carpentry items as indicated .
 - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Preservative Treatment:
 1. Preservative Pressure Treatment of Plywood Above Grade: AWP A U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
 - a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

- B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.03 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.04 INSTALLATION OF CONSTRUCTION PANELS

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
 - 1. Install plywood wall sheathing in accordance with manufacturer's current ICC-ES evaluation report for specified sheathing product.
 - 2. Use plywood or other acceptable structural panels at building corners, for not less than 96 inches (2440 mm), measured horizontally.
 - 3. Provide inlet diagonal bracing at corners.
 - 4. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.
- B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.
 - 4. Size and Location: As indicated on drawings.
- C. Wall Sheathing and Roof Sheathing with Laminated Water-Resistive Barrier and Air Barrier: Secure to studs in accordance with manufacturer's installation instructions.
 - 1. Install with laminated water-resistive and air barrier on exterior side of sheathing.
 - 2. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
 - 3. Use only mechanically attached and drainable EIFS and exterior insulation with wall sheathing with laminated water-resistive and air barrier.
 - 4. Apply manufacturer's standard seam tape to joints between sheathing panels; use tape gun or hard rubber roller in accordance with manufacturer's installation instructions.
- D. Composite continuous insulation and plywood wall panels.
 - 1. Install in accordance with manufacturer's instructions.
 - 2. Install in exterior spaces without gaps or voids. Do not compress insulation.
 - 3. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.
 - 4. Fasten composite insulation to the structural base wall. Coordinate with the cladding or wall finish manufacturer for the attachment requirements over insulation panels. Contact manufacturer for guidance when determining fastening pattern.
 - 5. Install exterior cladding as recommended by the cladding manufacturer and as specified in other sections of this specification.

3.05 TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
- B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.06 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Coordination of ABAA Tests and Inspections:
 - 1. Provide testing and inspection required by ABAA QAP.
 - 2. Notify in ABAA writing of schedule for air barrier work. Allow adequate time for testing and inspection.
 - 3. Cooperate with ABAA testing agency.
 - 4. Allow access to air barrier work areas and staging.
 - 5. Do not cover air barrier work until tested, inspected, and accepted.

3.07 PROTECTION

- A. Protect installed products until completion of project.
- B. Cover the top and edges of unfinished composite insulation and plywood wall panel work to protect it from the weather and to prevent accumulation of water in the cores of the panels.
- C. Composite insulation and plywood wet panels shall be allowed to completely dry prior to application of vapor barrier and/or cladding.
- D. Repair or replace damaged products.

END OF SECTION

SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Hardware.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- C. Section 06 6100 - Cast Polymer Fabrications: Solid surfacing fabrications and wall panels.
- D. Section 12.3553.13 - Metal Laboratory Casework.
- E. Section 12.3553.23 - Solid-Plastic Laboratory Casework.
- F. Section 12 3600 - Countertops Solid surface countertops and window sills.

1.03 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).
- B. ANSI A208.1 - American National Standard for Particleboard; 2022.
- C. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- F. BHMA A156.9 - Cabinet Hardware; 2020.
- G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
- C. Product Data: Provide data for hardware accessories.
- D. Samples for Verification: Provide the following:
 - 1. Plastic Laminates, 8 x 10 inch for each type, color, pattern and surface finish.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Single Source Responsibility: Provide and install this work from single fabricator.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets:
- C. Cabinets:
 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
 2. Finish - Exposed Interior Surfaces: Decorative laminate.
 3. Finish - Semi-Exposed Surfaces: Decorative laminate
 4. Finish - Concealed Surfaces: Manufacturer's option.
 5. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
 6. Door and Drawer Front Retention Profiles: Fixed panel.
 7. Casework Construction Type: Type A - Frameless.
 8. Interface Style for Cabinet and Door: Style 1 - Overlay; reveal overlay.
 9. Cabinet Style: Flush overlay.
 10. Cabinet Doors and Drawer Fronts: Flush style.
 11. Drawer Construction Technique: Dovetail joints.

2.02 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.

2.03 PANEL CORE MATERIALS

- A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.
 1. Grade: M-2; moisture resistance: MR10.
 2. Panel Thickness: 3/4 inch (19.1 mm).
- B. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.
 1. Grade: 115; moisture resistance: MR10.
 2. Panel Thickness: 3/4 inch (19.1 mm).

2.04 THERMALLY FUSED LAMINATE PANELS

- A. Thermally Fused Laminate (TFL): Melamine- or polyester-resin-saturated decorative papers; for fusion to composite wood substrates under heat and pressure.
 1. Test in accordance with NEMA LD 3 Section 3.
 2. Panel Core Substrate: Particleboard.
 3. Color: White.

2.05 LAMINATE MATERIALS

- A. Manufacturers:

1. As indicated on drawings.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- C. Provide specific types as indicated.
 1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, through color, finish as indicated.
 2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, through color, finish as indicated.
 3. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.06 COUNTERTOPS

- A. Countertops: See Section 12 3600.

2.07 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
 1. Color: As indicated on drawings.
- C. Grommets: Standard plastic grommets for cut-outs, 3 inch OD, with matching plastic caps with slot for wire passage
 1. Product: Doug Mockett & Company, Inc., "SG Series", or approved equal.
 - a. Color: To be selected by the Architect.
- D. Closet Rod:
 1. Product: Knappe and Vogt; 750 Series Extra Heavy-Duty Round Closet Rod and 735 Wall-Mount Flanges, or approved equal.
 2. Location: Coat Racks at Alcoves 104.1 and 108.1

2.08 HARDWARE

- A. Cabinet Hardware: Comply with BHMA A156.9 for hardware types and grades specified.
 1. Hardware Types: As indicated on drawings.
 2. Product Grade: Grade 2.
- B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.
- C. Countertop Support and workstation Brackets: Fixed, L-shaped, face-of-stud mounting.
 1. Materials: Steel; T-shape cross-section.
 - a. Finish: Manufacturer's standard, factory-applied, powder coat.
 - b. Color: Almond.
 - c. Height and Length: As indicated on drawings.
 2. Products:
 - a. A&M Hardware, Inc; Heavy-Duty Hybrid Brackets.
- D. Vanity Brackets: Fixed, ADA-compliant, face-of-stud mounting.
 1. Material and Shape: Steel; formed compound shapes.
 - a. Finish: Manufacturer's standard, factory-applied, textured powder coat.
 - b. Color: White.
 2. Products:
 - a. A&M Hardware, Inc; ADA Vanity Brackets.

- E. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers ("U" shaped wire pull, steel with satin finish, 100 mm centers).
- F. Keyed Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
- G. Cabinet Catches and Latches:
 - 1. Type: Magnetic catch and Push latch.
- H. Drawer Slides:
 - 1. Type: Full extension with overtravel.
 - 2. Static Load Capacity: Heavy Duty grade (Grade 1HD-100 and Grade 1HD-200).
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
 - 5. Features: Provide self closing/stay closed type.
- I. Hinges: European style concealed self-closing type, steel with nickel-plated finish.
 - 1. Soft Close, 110 degrees of opening.
- J. Hinges: (At Trash Cabinets Enclosure at Alcove C105.1)
 - 1. 2 1/2 inch, 5-knuckle hinges made from 0.093 inch thick metal as follows:
 - a. Rockford Process Control (RPC) Model No. 376 26D.
- K. Closet Rod: Products: Knappe and Vogt; 750 Series Extra Heavy-Duty Round Closet Rod and 735 Wall-Mount Flanges. Location: Coat Racks at Alcoves 104.1 and 108.1
 - 1. Products:
 - a. Knappe and Vogt; 750 Series Extra Heavy-Duty Round Closet Rod and 735 Wall-Mount Flanges.
 - b. Location: Coat Racks at Alcove

2.09 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.
- E. Secure cabinets to floor using appropriate angles and anchorages.

- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

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**SECTION 06 6100
CAST POLYMER FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Solid surfacing fabrications:
 - 1. Solid Surface Sheet (Wall Panels).
 - 2. Shower Receptors and Shower Surrounds.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 07 9200 - Joint Sealants.
- C. Section 12 3600 - Countertops: For solid surface countertops.
- D. Section 22 4000 - Plumbing Fixtures: For shower drain, strainer and controls.

1.03 REFERENCE STANDARDS

- A. American with Disabilities Act Accessibility Guidelines (ADAAG).
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- C. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data for fabricated units.
- C. Shop Drawings: For each type of cast polymer, indicate:
 - 1. Plans and Elevations: Include dimensions and unit serial numbers; indicate location of fabricated units.
 - 2. Details: Include connections and plumbing system accommodations.
- D. Samples: For each solid surface panel type, two samples, 4 inches (102 mm) in length, indicating specified color.
- E. Manufacturer's Instructions: Indicate installation and handling instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in original packages, containers, or bundles bearing brand name and identification.
- B. Store products under cover, elevated above grade, and in dry, well-ventilated areas not exposed to heat or sunlight. Protect from moisture damage.
- C. Handle products to prevent damage to edges, ends, or surfaces, and in accordance with manufacturer's written instructions.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Solid Surface 10 Year Warranty against material and manufacturing defects.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Solid Surface Fabrications:
 - 1. Inpro Corporation: Prism (Basis-of-Design).
 - 2. Approved equal.

2.02 REGULATORY REQUIREMENTS

- A. Surface Burning Requirements:
 - 1. Interior Use: Flame spread index of 75 or less and smoke-development index of 450 or less; Class B interior finish classification when tested in accordance with ASTM E84.
- B. Performance Requirements:
 - 1. Comply with ANSI Z124.1.2-2005 when tested for workmanship and finish, structural integrity and material characteristics.
 - 2. Provide shower receptors that conform to ANSI 124.1.2-2005 when tested for workmanship and finish, structural integrity, and material characteristics.
 - 3. Fungal and Bacterial Resistance: Provide Prism™ Solid Surface that does not support fungal and bacterial growth as tested in accordance with ASTM G-21 and ASTM G-22.

2.03 SOLID SURFACING FABRICATIONS

- A. Solid Surfacing: Densified, homogeneous, nonporous castings fabricated into sheets; composed of acrylic resins, fillers, color chips, and pigment and performance-enhancing additives.
- B. Applications: Solid Surface Sheet - Wall Panels (SSP-1):
 - 1. Style: As indicated on drawings.
 - 2. Height: As indicated on drawings.
 - 3. Thickness: 1/4 inch (6.4 mm).
 - 4. Edge: Eased
 - 5. Accesories:
 - a. Perimeter trim, 2 1/2" x 1/2"
 - b. Wall Base, 5" x 1/2"
 - 6. Color: As selected from manufacturer's standard range of colors.
- C. Applications: Shower Receptor and Shower Surround (SH-1 and SHP-1).
 - 1. Style: Custom ADA Shower Receptor
 - a. Recessed Pan size: As indicated on drawings.
 - b. Drain Location: Center.
 - c. Threshold: Accessible Compliant (ADA).
 - d. Water Barrier: Double (with flange), 1/2" thick x 4 1/2" high water barrier with 1/4" thick x 5 1/2" high flange.
 - 2. Shower Surround (Wall Panels): To match receptor size:
 - a. Thickness: 1/4 inch (6.4 mm).
 - b. Edge Profiles: Eased.
 - 3. Color: As selected from manufacturer's standard range of colors.
 - 4. Finish on Exposed Surfaces: Manufacturer's standard for application.

2.04 FABRICATION

- A. Fabricate cutouts where indicated.
- B. Provide consistent finish over exposed surfaces matching approved samples.
- C. Fabrication Tolerances:
 - 1. Maximum Variation from Specified Thicknesses: 1/16 inch (1.59 mm).
 - 2. Maximum Variation from Specified Dimensions: 1/8 inch (3.18 mm).

3. Maximum Variation from Dimensioned Cutout Locations: 1/4 inch (6.35 mm).

2.05 ACCESSORIES

- A. Fasteners: Threaded fasteners as recommended by cast polymer manufacturer; type and size to suit application:
 1. Low Corrosion Risk: Carbon steel with zinc-plated coatings.
- B. Adhesives: Type recommended by cast polymer manufacturer for application; not containing formaldehyde or volatile organic compounds.
- C. Joint Sealants: Type recommended by cast polymer manufacturer for application.
- D. Joint Sealants: See Section 07 9200.

PART 3 EXECUTION

3.01 PREPARATION

- A. Prepare substrates in accordance with manufacturer's written instructions.

3.02 INSTALLATION

- A. Install cast polymer units in accordance with manufacturer's written instructions.
- B. Install wall, tub surround, and shower surround panels over continuous substrate.
- C. Align work plumb and level.

3.03 TOLERANCES

- A. Maximum Variation from True Position: 1/4 inch (6.4 mm).
- B. Maximum Variation from Plumb: 1/4 inch in 10 feet (2 mm in 1 m).
- C. Maximum Variation from Level: 1/4 inch in 10 feet (2 mm in 1 m).

3.04 CLEANING

- A. Clean exposed surfaces of installed units in accordance with manufacturer's instructions.

3.05 PROTECTION

- A. Protect installed cast polymer units from subsequent construction operations.

END OF SECTION

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**SECTION 07 0150.19
PREPARATION FOR RE-ROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Replacement of existing roofing system in preparation for new roofing system in designated areas as indicated on drawings.
- B. Removal of existing flashing and counterflashings.
- C. Temporary roofing protection.

1.02 RELATED REQUIREMENTS

- A. Section 07 5200 - Modified Bituminous Membrane Roofing.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with affected mechanical and electrical work associated with roof penetrations.
- B. Preinstallation Meeting: Convene two weeks before starting work of this section.
 - 1. Attendees:
 - a. Architect.
 - b. Contractor.
 - c. Owner.
 - d. Installer.

1.04 FIELD CONDITIONS

- A. Existing Roofing System: Built-up asphalt roofing.
- B. Do not remove existing roofing membrane when weather conditions threaten the integrity of building contents or intended continued occupancy.
- C. Maintain continuous temporary protection prior to and during installation of new roofing system.
- D. Provide notice at least three days before starting activities that will affect normal building operations.
- E. Owner will occupy building areas directly below re-roofing area.
 - 1. Provide Owner with at least 48 hours written notice of roofing activities that may affect their operations and to allow them to prepare for upcoming activities as necessary.
 - 2. Do not disrupt Owner's operations or activities.
- F. Prior to re-roofing, the contractor shall conduct an infrared thermographic scan of the existing roof to assess the condition of the existing insulation and identify any areas where the insulation may be wet or damaged. Refer to drawings for additional information.

PART 2 PRODUCTS

2.01 COMPONENTS

- A. See the following sections for additional information on components relating to this work:
 - 1. Replacement and removal of existing roofing system in preparation for new roofing system in designated areas as indicated on drawings, see Section 07 5200.

2.02 MATERIALS

- A. Patching Materials: Provide necessary materials in accordance with requirements of existing roofing system.
- B. Temporary Roofing Protection Materials:
 - 1. Contractor's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing roof surface has been cleared of materials being removed from existing roofing system and ready for next phase of work as required.

3.02 PREPARATION

- A. Sweep roof surface clean of loose matter.
- B. Remove loose refuse and dispose of properly off-site.

3.03 MATERIAL REMOVAL

- A. Remove only existing roofing materials that can be replaced with new materials the same day.
- B. Remove metal counter flashings.
- C. Remove damaged portions of roofing membrane, perimeter base flashings, flashings around roof protrusions, pitch pans and pockets and insulation vents.
- D. Remove damaged insulation and fasteners, cant strips, and blocking.

3.04 INSTALLATION

- A. Coordinate scope of this work with requirements for installation of new roofing system, see Section 07 5200 for additional requirements.

3.05 PROTECTION

- A. Provide protection of existing roofing system that is not having work performed on it.
- B. Provide temporary protective sheeting over uncovered deck surfaces.
- C. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights.
- D. Provide for surface drainage from sheeting to existing drainage facilities.
- E. Do not permit traffic over unprotected or repaired deck surface.

END OF SECTION

**SECTION 07 2100
THERMAL INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at perimeter foundation wall, underside of floor slabs, and exterior wall.
- B. Batt insulation in exterior wall construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 06 1000 - Rough Carpentry: For sheathing and composite continuous insulation with plywood wall panels.
- C. Section 07 2600 - Vapor Retarders: Separate vapor retarder materials.
- D. Section 07 5200 - Modified Bituminous Membrane Roofing. For board insulation specified as part of roof construction.
- E. Section 09 2916 - Gypsum Board Assemblies for acoustic insulation in interior partitions.

1.03 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024c.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- C. Insulation in Metal Framed Walls: Batt insulation with separate vapor retarder (vapor barrier).

2.02 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
 - 1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
 - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 4. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
 - 5. Products:
 - a. DuPont de Nemours, Inc; Styrofoam Brand Cavitymate Ultra.
 - b. Owens Corning Corporation; FOAMULAR Type NGX 250 Extruded Polystyrene (XPS) Insulation.

2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

- A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - 4. Thermal Resistance: R-value (RSI-value) as indicated on the drawings.
 - 5. Thickness: As indicated on the drawings.
 - 6. Facing: Unfaced.
 - 7. Products:
 - a. CertainTeed Corporation.
 - b. Johns Manville:
 - c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation.

2.04 COMPOSITE CONTINUOUS INSULATION PLYWOOD WALL PANELS

- A. Refer to Section 06 1000 - Rough Carpentry

2.05 ACCESSORIES

- A. Sheet Vapor Retarder: See Section 07 2600.
- B. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
 - 1. Application: Sealing of interior circular penetrations, such as pipes or cables.
 - 2. Width: Are required for application.
- C. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Adhere a 6 inches (152 mm) wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.
 - 1. Tape seal joints.

- B. Install boards horizontally on foundation perimeter.
 - 1. Place boards to maximize adhesive contact.
 - 2. Butt edges and ends tightly to adjacent boards and to protrusions.
- C. Extend boards over expansion joints, unbonded to foundation on one side of joint.
- D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION UNDER CONCRETE SLABS

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.04 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.
- F. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over face of member
- G. Tape seal tears or cuts in vapor retarder.
- H. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.
- I. Place insulation against baffles, and do not impede natural attic ventilation to soffit.

3.05 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

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**SECTION 07 2600
VAPOR RETARDERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vapor retarders (Vapor Barrier) on exterior walls.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 03 3000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.
- C. Section 06 1000 - Rough Carpentry: Air and water resistive barrier over exterior wall sheathing.
- D. Section 07 5200 - Modified Bituminous Membrane Roofing: Vapor retarder installed as part of roofing system.

1.03 DEFINITIONS

- A. Vapor Retarder: Airtight barrier made of material that is relatively water vapor impermeable, to degree specified, with seams and joints sealed to adjacent surfaces.
- B. Vapor Retarder Class: A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class is defined using Procedure A, Desiccant Method at 73 degrees F (23 degrees C) and 50 percent Relative Humidity (RH), in accordance with ASTM E96/E96M and ICC (IBC)-2018, as follows:
 - 1. Class I: 0.1 perm or less.
 - 2. Class II: Greater than 0.1 perm to 1.0 perm.
 - 3. Class III: Greater than 1.0 perm to 10 perms.

1.04 REFERENCE STANDARDS

- A. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications; 2016 (Reapproved 2023).
- B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

PART 2 PRODUCTS

2.01 VAPOR RETARDERS

- A. Vapor Retarder Sheet (Vapor Barrier): Polyethylene sheeting complying with ASTM D4397, clear colored.
 - 1. Thickness: 10 mil, 0.010 inch (0.254 mm), nominal.
 - 2. Seam and Perimeter Tape: Polyethylene self-adhering type, mesh reinforced, 2 inches (50 mm) wide; compatible with sheet material.

2.02 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Vapor Retarder and Adjacent Substrates: As indicated, complying with vapor retarder manufacturer's installation instructions.
- B. Sealant for Cracks and Joints in Substrates: Resilient elastomeric joint sealant compatible with substrates and vapor retarder materials.
 - 1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch (0.76 to 1.02 mm), nominal thickness.
 - 2. Color: Green.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions comply with requirements of this section.

3.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Vapor Retarders: Install continuous airtight barrier over surfaces indicated, with sealed seams and sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- F. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.04 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.
- B. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION

SECTION 07 4113.16
STANDING-SEAM METAL ROOF PANELS

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 standing-seam metal roof panels.
- B. Related Sections:
 - 1. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
 - 2. Section 07 4213.53 "Metal Soffit Panels" for metal panels used in horizontal soffit applications.

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 of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal 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. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel 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 rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).
- B. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- C. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
- D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- E. 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 (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 CURVED STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
 - 1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
- B. Curved Vertical-Rib, Snap-Lock, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 0.028 inch (0.71 mm).
 - b. Exterior Finish: Three-coat fluoropolymer.
 - c. Color: As selected from manufacturer's standard colors.
 - 3. Clips: One-piece fixed to accommodate thermal movement.
 - a. Material: 0.028-inch-(0.71-mm)-0.064-inch-(1.63-mm) nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - 4. Panel Coverage: 18 inches (457 mm).

5. Panel Height: 1.50 inches.
6. Basis-of-Design Product: Subject to compliance with requirements, provide Dimensional Metals, Inc. Curved Snap-On-Seam CR-SS10 Color: comparable product by the following:
 - a. PAC-CLAD Company
 - b. Berridge Mfg. Company

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils (0.76 mm) thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
 1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.

2.4 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fascia, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal 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-(25-mm-)thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels 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. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.5 FABRICATION

- A. General: 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. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 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.
 - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. 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 (0.013 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 - 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply over the entire roof surface.
 - a. Valleys, from lowest point to highest point, for a distance on each side of 18 inches (460 mm). Overlap ends of sheets not less than 6 inches (152 mm).
- B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 07 6200 "Sheet Metal Flashing and Trim."

3.4 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
1. Install clips to supports with self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 4. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Clipless Metal Panel Installation: Fasten metal panels to supports with screw fasteners at each lapped joint at location and spacing recommended by manufacturer.
- G. Accessory Installation: 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 panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
- H. 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 as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without 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 achieve 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 (3 m) with no joints allowed within 24 inches

(610 mm) of corner or intersection. Where lapped 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 (25 mm) deep, filled with mastic sealant (concealed within joints).

- I. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 4213.23
METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior cladding consisting of formed metal composite material (MCM) sheet - Rain-Screen System.
- B. Exterior cladding consisting of formed metal composite material (MCM) sheet - Wet, Sealed Screen System.
- C. Matching, coping, flashing and trim.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 05 4000 - Cold-Formed Metal Framing: Panel support framing.
- C. Section 06 1000 - Rough Carpentry: For composite continuous insulation and plywood wall panels, and air & water resistive barrier.
- D. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.
- E. Section 07 9200 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- E. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2024.
- F. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2023b.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- H. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- I. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2023.
- J. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- K. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

- L. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives; 1998 (Reapproved 2021).
- M. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2023.
- N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- O. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- P. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).
- Q. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).
- R. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Convene one week before starting work of this section to verify project requirements, coordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturers' installation instructions and warranty requirements.
 - 1. Require attendance by the installer and relevant sub-contractors.
 - 2. Include MCM sheet manufacturer's representative and wall system manufacturer's representative to review storage and handling procedures.
 - 3. Review in detail truck transportation, parking, vertical transportation, schedule, personnel, installation of adjacent materials and substrate.
 - 4. Review procedures for protection of work and other construction.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
 - 1. Finish manufacturer's data sheet showing physical and performance characteristics.
 - 2. Storage and handling requirements and recommendations.
 - 3. Fabrication instructions and recommendations.
 - 4. Specimen warranty for finish, as specified herein.
- C. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
 - 1. Physical characteristics of components shown on shop drawings.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation instructions and recommendations.
 - 4. Specimen warranty for wall system, as specified herein.
- D. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, support clips, exposed fasteners, number of anchors, supports, reinforcement, trim, flashings, and accessories.
 - 1. Indicate panel numbering system.
 - 2. Differentiate between shop and field fabrication.
 - 3. Indicate substrates and adjacent work with which the wall system must be coordinated.
 - 4. Include large-scale details of anchorages and connecting elements.
 - 5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches (1:10).
 - 6. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

- E. Selection Samples: For each finish product specified, submit at least two sample color chips representing manufacturer's custom range of available colors and patterns.
 - 1. Sealant Color: Color to match wall panels.
 - 2. Include samples of trim and accessories.
- F. Design Data: Submit structural calculations stamped by design engineer, for Architect's information and project record.
- G. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.
- H. Test Report: Submit test report verifying compliance with NFPA 285 for previously-tested exterior wall assembly.
- I. Manufacturer's Field Reports: Provide within 48 hours of field review. State what was observed and what changes, if any, were requested or required.
- J. Installer's qualification statement.
- K. Testing agency's qualification statement.
- L. Maintenance Data: Care of finishes and warranty requirements.

1.06 QUALITY ASSURANCE

- A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.
- B. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- C. Manufacturer Qualifications: Company specializing in manufacturing wall panel systems specified in this section.
 - 1. With not less than five years of documented experience.
 - 2. Approved by MCM sheet manufacturer.
- D. Installer Qualifications: Company specializing in performing work of type specified in this section.
 - 1. With minimum five years of documented experience.
 - 2. Approved by wall panel system manufacturer.
- E. Testing Agency Qualifications: Independent agency experienced in testing assemblies of the type required for this project and having the necessary facilities for full-size mock-up testing of the type specified.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
 - 1. Protect finishes by applying heavy-duty removable plastic film during production.
 - 2. Package for protection against transportation damage.
 - 3. Provide markings to identify components consistently with drawings.
 - 4. Exercise care in unloading, storing, and installing panels to prevent bending, warping, twisting, and surface damage.
- B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
 - 1. Store in well-ventilated space out of direct sunlight.
 - 2. Protect from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.
 - 3. Store at a slope to ensure positive drainage of accumulated water.
 - 4. Do not store in enclosed space where ambient temperature can exceed 120 degrees F (49 degrees C).

5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.08 WARRANTY

- A. Special Warranty: Provide 2-year warranty covering water tightness and integrity of seals of wall panels. Complete forms in Owner's name and register with warrantor.
- B. Finish Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Composite Material (MCM) Sheet Manufacturers:
 1. ALUCOBOND by 3A Composites USA; ALUCOBOND PLUS.
 2. ALPOLIC Materials; ALPOLIC/fr (Fire Retardant core).
- B. Wall Panel System Manufacturers:
 1. Coated Metals Group (CMG By Altiers Architectural Products) Basis-of-Design:
 - a. Rain Screen System 2000 (New Additions)
 - b. Wet, Sealed Screen System 1000 (Existing Building).
 2. Approved Equal.

2.02 WALL PANEL SYSTEM

- A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage, or failure.
 1. Provide structural design by or under direct supervision of a Structural Engineer licensed in the State in which the Project is located.
 2. Provide panel jointing and weatherseal using a "wet", sealant-sealed system.
 3. Anchor panels to supporting framing without exposed fasteners.

2.03 PERFORMANCE REQUIREMENTS

- A. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F (minus 29 degrees C) to 180 degrees F (82 degrees C) without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.
 1. Wind Performance: Provide system tested in accordance with ASTM E330/E330M without permanent deformation or failures of structural members under the following conditions:
 - a. Wind Loads: As indicated o
 2. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.
 3. Maximum anchor deflection in any direction of 1/16 inch (1.6 mm) at connection points of framing members to anchors.
- B. Air Leakage: 0.10 cfm/sq ft (0.50 L/sec sq m) maximum leakage when tested at 1.57 psf (75 Pa) pressure difference in accordance with ASTM E283/E283M.
- C. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 6.27 psf (300 Pa) minimum, after 15 minutes.
 1. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.

2. Design to drain leakage and condensation to the exterior face of the wall.
- D. Fire Performance: Use test method complying with NFPA 285.

2.04 PANELS

- A. Panels: 2-inch- (50.8 mm) deep pans -Rain Screen System and 3-inch (76.2 mm) deep pans for Wet Screen System (to match existing system depth). Pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
 1. Reinforce corners with riveted aluminum angles.
 2. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
 3. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
 4. Secure members to back face of panels using structural silicone sealant approved by MCM sheet manufacturer.
 5. Fabricate panels under controlled shop conditions.
 6. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
 7. Fabricate as indicated on drawings and as recommended by MCM sheet manufacturer.
 - a. Make panel lines, breaks, curves, and angles sharp and true.
 - b. Keep plane surfaces free from warp or buckle.
 - c. Keep panel surfaces free of scratches or marks caused during fabrication.
 8. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.

2.05 MATERIALS

- A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a core of extruded thermoplastic material; no foamed insulation material content.
 1. Overall Sheet Thickness: 0.157 inch (4 mm), minimum.
 2. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch (100 N-mm/mm) with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F (21 degrees C).
 3. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 4. Flammability: Self-ignition temperature of 650 degrees F (343 degrees C) or greater when tested in accordance with ASTM D1929.
- B. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
 1. Provide material strength, dimensions, configuration as required to meet applied loads and in compliance with applicable building code.
 2. Sheet Steel Components: ASTM A653/A653M galvanized to G90/Z275 or zinc-iron alloy-coated to A60/ZF180; or ASTM A792/A792M aluminum-zinc coated to AZ60/AZM180.

2.06 FINISHES

- A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, with at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss as scheduled:
 1. Colors: Refer to drawings for locations.

- a. MPNL-1: White
 - b. MPNL-2: Gray, custom color to match existing.
 - c. MPNL-3: Blue, custom color to match existing.
- B. Fluoroethylene Vinyl Ether (FEVE) Coating: Superior performing resin based organic powder coatings system complying with AAMA 2605; single coat applications when applied to aluminum with dry film thickness (DFT) of 2 to 3 mil, 0.002 to 0.003 inch (0.051 to 0.076 mm); color and gloss as scheduled.
1. Apply coating to exposed metal surfaces with proper preparation and pretreatment in accordance with resin manufacturer's instructions.

2.07 ACCESSORIES

- A. Flashing: Sheet aluminum; 0.040 inch (1.0 mm) thick, minimum; finish and color to match MCM sheet; see Section 07 6200 for additional requirements.
- B. Anchors, Clips, and Accessories: Use one of the following:
1. Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666/A666M.
 2. Steel complying with ASTM A36/A36M and hot-dip zinc coating to ASTM A153/A153M.
 3. Steel complying with ASTM A36/A36M and hot-dip galvanized to ASTM A123/A123M, with Coating Thickness Grade of 100.
- C. Joint Sealer: Provide color to match wall panels elastomeric polyurethane or silicone sealant of type approved by MCM sheet manufacturer, and in compliance with ASTM C920.
- D. Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices, and attachments.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine dimensions, tolerances, and interfaces with other work.
- B. Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Notify Architect in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protect adjacent work areas and finish surfaces from damage during installation.

3.03 INSTALLATION

- A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.
- B. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.
- C. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.
- D. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

- E. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with MCM sheet manufacturer's instructions and recommendations for field forming.
- F. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.
- G. Where joints are designed for field-applied sealant, seal joints completely with specified sealant.
- H. Install flashings as indicated on shop drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.
- I. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
 - 1. Variation From Plane or Location: 1/2 inch in 30 feet (10 mm in 10 m) of length and up to 3/4 inch in 300 feet (20 mm in 100 m), maximum.
 - 2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet (3 mm in 9 m) run, maximum.
 - 3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet (3 mm in 9 m) run, maximum.
 - 4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch (0.75 mm), maximum.
- J. Replace damaged products.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Wall System Manufacturer's Field Services: Provide field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with instructions.
- C. Wet, Sealed Screen System: Water-Spray Test after installation, test area of assembly for water penetration in accordance with AAMA 501.2.

3.05 CLEANING

- A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.
- B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.
- C. Remove temporary coverings and protection of adjacent work areas.
- D. Clean installed products in accordance with manufacturer's instructions.

3.06 PROTECTION

- A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 07 4213.53
METAL SOFFIT PANELS (LINEAR PANELS)

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 metal soffit panels.
- B. Related Sections:
 - 1. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
 - 2. Section 07 4113.16 "Standing-Seam Metal Roof Panels" for roof panels.

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 of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Shop drawings to be prepared by the manufacturer.
 - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency that meets or exceeds minimum standards.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Material Manufacturer will provide minimum two days a week job inspections during installation and weekly progress reports.
- B. Manufacturer must have minimum 20 years of experience in metal roofing.
- C. All roofing, wall panels and soffits are to be from one manufacturer with one system warranty.
- D. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer with no less than 10 years experience with the roofing system specified and no less than 5 roofs of similar scope.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal 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. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel 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 rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

- b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. 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 (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METAL SOFFIT PANELS

- A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Concealed-fastener Soffit Panels: Unperforated and vented linear panels.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dimensional Metals, Inc. Basis-of-Design Product: Subject to compliance with requirements, provide Flush-Panel Soffit (FP10) or comparable product by one of the following:
 - b. PAC-CLAD Company
 - c. Berridge Mfg. Company
 - 2. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - 3. Thickness: 0.040 inch.
 - 4. Surface: Smooth, flat finish.
 - 5. Exterior Finish: Two-coat fluoropolymer
 - 6. Color: As selected from manufacturer's standard colors.
 - 7. Panel Coverage: 8 inches at new curved Entrance Canopy

- 8. 12 inches at existing Vehicular Canopy
- 9. Panel Height: 1 inches.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.4 FABRICATION

- A. General: 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. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other 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 substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
 - 2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.
 - a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.
 - 1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
- B. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- C. Watertight Installation
- D. Accessory Installation: 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 panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- E. 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 as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.4 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

**SECTION 07 4646
FIBER-CEMENT SIDING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiber-cement trim.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 07 9200 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.
- C. Section 09 9113 - Exterior Painting: Field painting.

1.03 REFERENCE STANDARDS

- A. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets; 2022, with Editorial Revision (2023).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's requirements for related materials to be installed by others.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods, including nail patterns.
- C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.
- D. Manufacturer's qualification statement.
- E. Installer's qualification statement.
- F. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.
- G. Warranty: Submit copy of manufacturer's warranty, made out in Owner's name, showing that it has been registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified in this section with not less than three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials in manufacturer's unopened packaging, with labels intact, until ready for installation.
- B. Store materials under dry and waterproof cover, well ventilated, and elevated above grade on a flat surface.

- C. Protect materials from harmful environmental elements, construction dust, and other potentially detrimental conditions.

1.07 FIELD CONDITIONS

- A. Do not install panels when air temperature or relative humidity are outside manufacturer's limits.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking and deforming.
 - b. Deterioration of materials beyond normal weathering.
- C. Warranty Period: 30 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 FIBER-CEMENT TRIM.

- A. Trim: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
 - 1. Style: Standard lap style.
 - 2. Texture: Simulated rough sawn grain.
 - 3. Length: 12 feet (3.7 m), nominal.
 - 4. Width (Height): 5 1/2 inches (140 mm)
 - 5. Thickness: 3/4 inch (19 mm), nominal.
 - 6. Finish: Factory applied primer.
 - 7. Warranty: 30 year limited; transferable.
 - 8. Products:
 - a. James Hardie Building Products, Inc.; Basis-of-Design, or approved equal.
 - 1) James Hardie, Hardie Trim, Roughsawn.

2.02 ACCESSORIES

- A. Fasteners: Galvanized or corrosion resistant; length as required to penetrate, 1-1/4 inches (31.8 mm), minimum.
- B. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.
- B. Do not begin until unacceptable conditions have been corrected.
- C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Protect surrounding areas and adjacent surfaces during execution of this work.

3.03 INSTALLATION

- A. Install siding in accordance with manufacturer's instructions and recommendations.
 - 1. Read warranty and comply with terms necessary to maintain warranty coverage.
 - 2. Use trim details as indicated on drawings.
 - 3. Touch up field cut edges before installing.
 - 4. Pre-drill nail holes if necessary to prevent breakage.
- B. Over Steel Studs: Use hot-dipped galvanized self-tapping screws, with the points of at least three screws penetrating each stud the panel crosses and at panel ends.
- C. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.
- D. Joints in Horizontal Trim: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.
- E. Do not install trim less than 6 inches (152 mm) from ground surface, or closer than 1 inch (25.4 mm) to roofs, patios, porches, and other surfaces where water may collect.
- F. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.

3.04 CLEANING

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Clean faced panels in accordance with manufacturer's maintenance instructions, using cleaning materials and methods acceptable to manufacturer.

3.05 PROTECTION

- A. Protect installed products until Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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**SECTION 07 5200
MODIFIED BITUMINOUS MEMBRANE ROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. SBS Modified bituminous roofing membrane, torch applied.
- B. Insulation, flat and tapered.
- C. Vaporbarrier.
- D. Cover boards.
- E. Roofing cant strips and walkway pads.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 06 1000 - Rough Carpentry: Wood cant strips.
- C. Section 07 0150.19 - Preparation for Re-Roofing.
- D. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashings, reglets.
- E. Section 07 7100 - Roof Specialties: Prefabricated roofing expansion joint flashing.
- F. Section 08 6200 - Unit Skylights: Skylight frame, integral curb, and counterflashing.
- G. Section 22 1006 - Plumbing Piping Specialties: Roof drains.

1.03 REFERENCE STANDARDS

- A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.
- B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.
- C. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2023).
- D. ASTM D312/D312M - Standard Specification for Asphalt Used in Roofing; 2016a (Reapproved 2023).
- E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2024).
- F. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2025.
- G. FM (AG) - FM Approval Guide; Current Edition.
- H. NRCA (RM) - The NRCA Roofing Manual; 2025.
- I. UL (DIR) - Online Certifications Directory; Current Edition.
- J. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of associated flashings and counterflashings installed by other sections.
- B. Preinstallation Meeting: Convene one week before starting work of this section.

1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's catalog data for membrane and bitumen materials, base flashing materials, insulation, vapor retarder, and surfacing.
- C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and mechanical fastener layout.
- D. Samples: Submit two samples 8 by 8 inches (304 by 304 mm) in size illustrating granule surfaced sheet, colored coated sheet, and insulation.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Manufacturer's qualification statement.
- H. Installer's qualification statement.
- I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact unless otherwise indicated.
- B. Store materials in weather protected environment, clear of ground and moisture; ballast materials may be stored outdoors.
- C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

1.08 FIELD CONDITIONS

- A. Do not apply roofing membrane when environmental conditions are outside the ranges recommended by manufacturer.
- B. Do not apply roofing membrane during unsuitable weather.
- C. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C).
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- F. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

- B. Provide 20-year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Modified Bituminous Membrane Roofing System:
 - 1. Elevate (Basis-of-Design).
 - 2. Soprema.
 - 3. Johns Manville.
- B. Insulation:
 - 1. Same manufacturer as roof membrane.
- C. Cover Boards:
 - 1. Same manufacturer as roof membrane.
 - 2. Georgia Pacific; Dense Deck.
- D. Vapor Barrier:
 - 1. Same manufacturer as roof membrane.
- E. Metal Roof Edging:
 - 1. Same Manufacturer as roof membrane.

2.02 ROOFING SYSTEM DESCRIPTION

- A. Systems:
 - 1. New Addition: Modified Bituminous Membrane Roofing: Two-ply membrane, with vapor barrier, tapered insulation and cover board.
 - 2. Existing Building: Modified Bituminous Membrane Roofing: Two-ply membrane and cover board. Resuse existing insulation, refer to drawings.
- B. Styrene-butadiene-styrene (SBS) modified bituminous mineral granule surfaced cap sheet and smooth base sheet.
 - 1. Membrane Attachment: Torch Applied Applied
 - 2. Slope: 1/4":12" Min (2%):
 - a. By means of tapered insulation at new Addition.
 - b. By means of sloped structural deck at Existing Building.
 - 3. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification.
- C. Vapor Barrier over steel deck:
 - 1. Membrane: High density polyethylene sheet with SBS modified bitumen adhesive.
 - 2. Attachment: Self-adhering.
- D. Polyisocyanurate (ISO) Board Insulation:
 - 1. Total Sytem R-Value: 30 minimum at New Addition.
 - a. Maximum Board Thickness: 3" (76.2 mm)
 - b. Use as many layers as necessary to achieve required R-value.
 - c. Stagger joints in adjacent layers
 - 2. Base Layer: Polyisocyanurate foam board, non-composite.
 - a. Attachment: Mechanical fastening.
 - 3. Fill Layers: Polyisocyanurate foam board.
 - a. Atachment: Low-rise polyurethane adhesive.
 - 4. Top Layer: Polyisocyanurate foam board, non-composite.
 - a. Atachment: Low-rise polyurethane adhesive.
- E. Cover Board: Gypsum-Based Cover Board.

1. Non-combustible, water-resistant gypsum core with embedded glass mat facers.
2. Type and thickness: as indicated in section below.
3. Attachment: Low-rise polyurethane adhesive.

2.03 MEMBRANE AND SHEET MATERIALS (SBS)

- A. Cap Sheet: Granule-surfaced SBS modified bitumen roofing membrane complying with ASTM D 6164 Type I Grade G, consisting of select asphalt, modified with styrene-butadiene-styrene, and strengthened with a fiberglass reinforced polyester nonwoven mat.
 1. Product: SBS FR Torch by Elevate (Basis-of-Design)
 2. Color: White
- B. Base Sheet: Smooth-surfaced modified bitumen roofing membrane complying with ASTM D 6164.
 1. Product: SBS Poly Torch Base by Elevate (Basis-of-Design)
- C. Membrane Fasteners: Type and size as required by roof membrane Manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane Manufacturer.
- D. Flashing Membrane: Same as field membrane
- E. Liquid Flashing Membrane: Two-component urethane elastomer.
- F. Membrane Adhesive: Asphalt matrix with non-asbestos fibers.
- G. Flashing Cement/Lap Adhesive: Asphalt matrix with non-asbestos fibers.
- H. Primer: Meeting ASTM D 41
- I. Pourable Sealer: One part polyurethane; Black or White, One-Part Pourable Sealer.
- J. Water Block Seal: Butyl rubber sealant for use between two surfaces, not exposed.
- K. Metal Plates and Strips used for Fastening Membrane and Insulation: Steel with Galvalume coating; corrosion-resistance meeting FM 4470 criteria.
- L. Termination Bars: Aluminum bars with integral caulk ledge; 1.3" (33 mm) wide by 0.10" (2.5 mm) thick;
- M. Roof Walkway Pads: Same as field membrane.
- N. Fire-Resistant Vapor Retarder: Reinforced Kraft paper laminate complying with requirements of fire rating classification; compatible with roofing and insulation materials.

2.04 COVER BOARDS

- A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M and with the following additional characteristics:
 1. Thickness: 1/4 inch (6.4 mm), fire-resistant.
 2. Size: 48" (1.22 m) by 96" (2.44 m), nominal (if mechanically fastened) or 48" (1.22 m) by 48" (1.22 m), nominal (if adhered).
 3. Surface Water Absorption: 2.5 g max., when tested in accordance with ASTM C 473.
 4. Surface Burning Characteristics: Flame spread of 0, smoke developed of 0, when tested in accordance with ASTM E 84.
 5. Combustibility: Non-combustible, when tested in accordance with ASTM E 136.
 6. Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
 7. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D 3273 for minimum of 4 weeks.

2.05 INSULATION

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam complying with ASTM C1289.
 1. Classifications:
 - a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.

- 1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
- 2) Compressive Strength: Classes 1-2-3, Grade 2 - 20 psi (138 kPa), minimum.
- 3) Thermal Resistance, R-Value per inch: 5.7R
- 4) Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
- 5) Product: ISOGARD GL polyiso board insulation by Elevate (Basis-of-Design).
2. Board Size: 48 by 96 inches (1,220 by 2,440 mm).
3. Board Thickness: As indicated elsewhere.
4. Tapered Board: Slope as indicated; as indicated on drawings; fabricate of fewest layers possible.
5. Insulation Fasteners: Type and size as required by roof membrane Manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane Manufacturer.
6. Low Rise Foam Adhesive: Two-component, low-rise polyurethane adhesive designed to attach polyisocyanurate insulation to a variety of acceptable substrates.

2.06 VAPOR BARRIER

- A. Vapor Barrier Membrane: Comprised of SBS modified bitumen adhesive, factory-laminated to a tri-laminate woven, high-density polyethylene top surface. Release liner protecting adhesive.
 1. Thickness: 10.2 mil. (0.26 mm).
 2. Max Load at Break at 73 °F (23 °C): 64 lbf/in, MD (11 kN/m) 88 lbf/in, XMD (15 kN/m) when tested in accordance with ASTM D 5147.
 3. Low Temperature Flexibility: -30 °F (-34 °C) when tested in accordance with ASTM D 5147.
 4. Moisture Vapor Permeance, 0.02 Perms (0.92 Ng/Pa•s•m²) maximum, when tested in accordance with ASTM E 96
 5. Air Permeability: 0.00114 ft³/min•ft² (0.007 L/sec•m²) maximum, when tested in accordance with ASTM E 2178.
 6. Product: V-Force FR Vapor Barrier Membrane by Elevate (Basis-of-Design)

2.07 ACCESSORIES

- A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailer.
 1. Description: Two-piece, 45° sloped galvanized steel sheet edge member securing top and bottom edges of formed metal fascia.
- B. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion.
- C. Anchor Bar Cleat: 20-gage, 0.036" (0.9 mm) G90 coated commercial type galvanized steel with pre-punched holes.
- D. Curved Applications: Factory modified.
- E. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted.
- F. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation.
- G. Wood Nailers: PS 20-dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
 1. Width: 3 ½" inches (90 mm), nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
 2. Thickness: Same as thickness of roof insulation.
- H. Cant Strips: Wood; pressure preservative treated.

- I. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
- J. Sealants: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 INSTALLATION - VAPOR BARRIER

- A. Vapor Barrier: Apply to deck surface with adhesive in accordance with roofing and vapor retarder manufacturers' instructions.
- B. Extend vapor retarder under cant strips and blocking.

3.03 INSTALLATION - INSULATION

- A. Ensure vapor retarder is clean and dry, continuous, and ready for application of roofing system.
- B. Install insulation in configuration and with attachment method(s) specified in PART 2, under Insulation.
- C. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.
- D. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4" (6 mm). Fill gaps greater than 1/4" (6 mm) with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4" (6 mm).
- E. Attachment of Insulation: Mechanically fasten each layer of insulation to deck in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.
- F. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.
- G. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- H. Do not apply more insulation than can be covered with membrane in same day.

3.04 INSTALLATION - MEMBRANE

- A. Install modified bituminous membrane roofing system in accordance with manufacturer's recommendations.
- B. Torch Application:
 - 1. Start at the low point with a full width sheet, fully unrolled and aligned; align and unroll remaining sheets during heat fusing operation.
 - 2. Fully heat weld sheets to substrate using methods recommended by roof membrane manufacturer.
 - 3. Maintain 3" (75 mm) side laps and 6" (150 mm) end laps. Maintain maximum possible spacing between laps of interply sheet(s) and laps of cap sheet.
 - 4. Broadcast granules into adhesive bleed-out at all laps.

5. Granule-surfaced Sheets: In areas that form the substrate for heat fusing, such as laps, flashings, and patches, embed the granules prior to fusing subsequent sheet. Apply additional granules to all exposed surfaces that have none or cover with additional piece of granule-surfaced material.
- C. Install membrane; lap and seal edges and ends permanently waterproof.
- D. Install smooth, free from air pockets, wrinkles, fish-mouths, or tears. Ensure full bond of membrane to substrate.
- E. At end of day's operation, install waterproof cut-off. Remove cut-off before resuming roofing.
- F. At intersections with vertical surfaces:
 1. Extend membrane over cant strips and up a minimum of 8 inches (203 mm) onto vertical surfaces.
 2. Apply flexible flashing over membrane.
- G. Around roof penetrations, mop in and seal flanges and flashings with flexible flashing.
- H. Coordinate installation of roof drains and related flashings.

3.05 FLASHING AND ACCESSORIES INSTALLATION

- A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane Manufacturer's recommendations and details.
- B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
 1. Follow roofing Manufacturer's instructions.
- C. Roofing Expansion Joints: Install as shown on drawings and as recommended by roofing Manufacturer.
- D. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces:
 1. Install weathertight flashing at all walls, curbs, parapets, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8" (200 mm) above membrane surface.
 2. Use the longest practical flashing pieces.
 3. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane Manufacturer's recommendations.
 4. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
 5. Provide termination directly to the vertical substrate as shown on roof drawings.
- E. Roof Drains:
 1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed Manufacturer's recommendations.
 2. Position membrane, then cut a hole for roof drain to allow 1/2" to 3/4" (12 to 19 mm) of membrane to extend inside clamping ring past drain bolts.
 3. Apply sealant on top of drain bowl where clamping ring seats below the membrane.
 4. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.
- F. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
- G. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2" (50 mm) deep, with at least 1" (25 mm) clearance from penetration, sloped to shed water.
- H. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by Manufacturer.

3.06 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Provide daily on-site attendance of roofing and insulation manufacturer's representative during installation of this work.
- C. Perform all corrections necessary for issuance of warranty

3.07 CLEANING

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Remove bituminous markings from finished surfaces.
- C. In areas where finished surfaces are soiled by bitumen or other source of soiling caused by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

3.08 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

**SECTION 07 6200
SHEET METAL FLASHING AND TRIM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, exterior penetrations, and other items indicated in Schedule.
- B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2024).
- E. CDA A4050 - Copper in Architecture - Handbook; Current Edition.
- F. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit two samples, 6 by 6 inches (152 by 152 mm) in size, illustrating metal finish color.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.

- C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.02 GUTTERS AND DOWNSPOUTS

- A. Gutters: SMACNA (ASMM) Rectangular profile.
- B. Downspouts: Rectangular profile.
- C. Gutters and Downspouts: Size indicated on drawings.
- D. Accessories: Profiled to suit gutters and downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.
- E. Downspout Boots: Cast iron.
- F. Seal metal joints.

2.03 FLASHING

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.04 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.
- B. Primer Type: Zinc chromate.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.38 mm).

3.03 INSTALLATION

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Secure gutters and downspouts in place with concealed fasteners.
- E. Connect downspouts to downspout boots, and grout connection watertight.

3.04 SCHEDULE

- A. Through-Wall Flashing in Masonry: Refer to Section 04 2613 Masonry Veneer
- B. Gutters and Downspouts: Pre-finished aluminum.
- C. Coping, Cap, Parapet, Sill and Ledge Flashings: Pre-finished aluminum.
- D. Flashings Associated with Shingle Roofing, including Valley, Hip, Ridge, Eave, Gutter Edge, Gable Edge, Chimney: Refer to Section 07 3113 Asphalt Shingles.
- E. Counterflashings at Roofing Terminations (over roofing base flashings): Formed aluminum.
- F. Roofing Penetration Flashings, for Pipes, Structural Steel, and Equipment Supports: Formed aluminum.

END OF SECTION

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**SECTION 07 7100
ROOF SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof control and expansion joint covers.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 06 1000 - Rough Carpentry: For wooden curbs or cants for mounting roof expansion joints.
- C. Section 07 5200 - Modified Bituminous Roofing Membrane: Roofing membrane and accessories.
- D. Section 07 9513 - Expansion Joint Cover Assemblies: Expansion covers for exterior and interior walls.

1.03 REFERENCE STANDARDS

- A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- C. NRCA (RM) - The NRCA Roofing Manual; 2025.
- D. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
- D. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Control and Expansion Joint Covers:
 - 1. MM Systems Corp.
 - 2. Nystrom Inc.
 - 3. Balco, Inc.

2.02 PERFORMANCE REQUIREMENTS

- A. General: Roof expansion joints shall withstand exposure to weather, remain watertight, and resist the movements indicated without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.

2.03 COMPONENTS

- A. Flanged Bellows Roof Expansion Joint: Manufactured, continuous, waterproof, joint-cover assembly, consisting of exposed membrane bellows, laminated to flexible, closed-cell support foam, and secured along each edge to a 3- to 4-inch-(76- to 100-mm-) wide metal flange for nailing to substrate. Provide each size and type indicated, splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation. Fabricate each assembly specifically for installation configuration indicated on Drawings (Type EXRJ-01 & EXRJ-02).
 - 1. Basis of Design: MM Systems Corp., or approved equal.
 - a. Wall to Wall Expansion Control System: Model ERJ
 - b. Roof to Wall Expansion Control System: Model ERJL
 - 2. Joint Movement Capability: Plus and minus 50 percent of joint.
 - 3. Joint Width: As indicated on Drawings.
 - 4. Material
 - a. Flange: Galvanized steel sheet
 - b. Bellow: Flexible Membrane Cover: 60 mil (1.5 mm) EPDM sheet.
 - 5. Color: Black
 - 6. Attachment Method: Mechanical fasteners.

2.04 ACCESSORIES

- A. Sealant for Joints in Linear Components: As recommended by component manufacturer.
- B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that deck, curbs, roof membrane, base flashing, blocking, and other items affecting work of this Section are in place and positioned correctly.
- B. Verify that rough openings for joint covers are correctly sized and located.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Install components and accessories to comply with manufacturer's instructions.
 - 1. Exterior conditions: Heat weld splices and intersections to form a continuous joint system.
- C. Splices: Splice roof expansion joints with materials provided by roof-expansion-joint manufacturer for this purpose, to provide continuous, uninterrupted, and waterproof joints.
 - 1. Install waterproof splices and prefabricated end dams to prevent leakage of secondary-seal membrane.
- D. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

- E. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

END OF SECTION

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**SECTION 07 8400
FIRESTOPPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).
- D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.
- E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.
- F. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2023a.
- G. ITS (DIR) - Directory of Listed Products; Current Edition.
- H. FM 4991 - Approval Standard of Firestop Contractors; 2013.
- I. FM (AG) - FM Approval Guide; Current Edition.
- J. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- K. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.
- L. UL (DIR) - Online Certifications Directory; Current Edition.
- M. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Installer's qualification statement.

1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
- B. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Trained by manufacturer.
 - 2. Verification of minimum three years documented experience installing work of this type.
 - 3. Verification of at least five satisfactorily completed projects of comparable size and type.

1.06 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products.
 - 2. Hilti, Inc.
 - 3. Specified Technologies Inc.

2.02 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- C. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
- B. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.04 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
 - 1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

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**SECTION 07 9200
JOINT SEALANTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 07 4213.23 - Metal Composite Material Wall Panels: Sealing metal wall panels.
- C. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.03 REFERENCE STANDARDS

- A. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.
- F. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Backing material recommended by sealant manufacturer.
 - 4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 5. Substrates the product should not be used on.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints:
 - a. Seal the following joints:

- 1) Wall expansion and control joints.
- 2) Joints between doors, windows, and other frames or adjacent construction.
- 3) Joints between different exposed materials.
2. Interior Joints:
 - a. Seal the following joints:
 - 1) Joints between door frames and window frames and adjacent construction.
 - 2) In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, and piping penetrations.
 - 3) In sound-rated wall and ceiling assemblies, seal joints between wall assemblies and ceiling assemblies; between wall assemblies and other construction; between ceiling assemblies and other construction.
3. Do Not Seal:
 - a. Joints indicated to be covered with expansion joint cover assemblies.
 - b. Joints where sealant installation is specified in other sections.
 - c. Joints between suspended ceilings and walls.

2.02 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.
- B. Colors: As selected by Architect.

2.03 NONSAG JOINT SEALANTS

- A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 1. Movement Capability: Plus and minus 50 percent, minimum.
 2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 4. Color: To be selected by Architect from manufacturer's standard range.
 5. Products:
 - a. Pecora Corporation.
 - b. Sika Corporation.
 - c. Tremco Commercial Sealants & Waterproofing; Spectrem 2 (Basis-of-Design).
- B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 1. Color: White.
 2. Products:
 - a. Pecora Corporation: www.pecora.com/#sle.
 - b. Sika Corporation.
- C. Hybrid Silane Polyether Sealant: ASTM C920, Grade NS, Uses NT, M, G, A, and O; single component; not expected to withstand continuous water immersion.
 1. Movement Capability: Plus and minus 35 percent.
 2. Color: To be selected by Architect from manufacturer's standard range.
 3. Products:
 - a. Tremco Incorporated, Dynomic FC, (Basis of Design).
 - b. Master Builders Solutions.
- D. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
 1. Color: To be selected by Architect from manufacturer's standard range.
 2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
 3. Products:

- a. Pecora Corporation.
- b. Sherwin-Williams Company.
- c. Tremco Commercial Sealants & Waterproofing; Tremflex 834: (Basis-of-Design) .

2.04 ACCESSORIES

- A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

END OF SECTION

**SECTION 07 9513
EXPANSION JOINT COVER ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Expansion joint cover assemblies:
 - 1. Exterior wall surfaces.
 - 2. Interior wall and ceiling surfaces.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 07 7100 - Roof Specialties: Roof expansion and control joint covers.

1.03 REFERENCE STANDARDS

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.
- C. Samples: Submit two samples 2 inch (50.8 mm) long, illustrating profile, dimension, color, and finish selected.
- D. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Expansion Joint Cover Assemblies:
 - 1. Construction Specialties, Inc.
 - 2. MM Systems Corp.
 - 3. Nystrom, Inc.

2.02 PERFORMANCE REQUIREMENTS

- A. Provide expansion joint cover assemblies of design, basic profile, materials and operation indicated required to accommodate joint size variations in adjacent surfaces, and as required for anticipated structural movement.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.

2.03 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

- A. Interior Wall/Ceiling Joints Subject to Thermal Movement (INJC-1 and INJC-2):
 - 1. Surface Mounted Metal Cover Plates: Concealed frame for fastening to wall on one side of joint. Extend cover to lap each side of joint and to permit free movement on one side. System with concealed attachments.
 - 2. Basis-of-Design: MM Systems Corp., or approved equal.
 - a. Wall-to-Wall Joint System; Model EX.
 - b. Wall/Ceiling Corner Joint Systems: Model EX-L.
 - 3. Joint Width: As indicated on Drawings.
 - 4. Material:
 - a. Exposed Metal Cover: Aluminum
 - 1) Finish: Class II, clear anodic or Kynar color options.
 - b. Gasket: ASTM D2000
 - 5. Type: Snap-on cover with steel clips.
- B. Exterior Wall Joints Subject to Thermal Movement (EXWJ-01):
 - 1. Preformed Foam Joint Seals: Manufacturer's standard, seismic pre-compressed vertical foam system seal designed for use in vertical, high movement joints. Expanding foam with silicone surface seal: flame resistant, watertight, wax and asphalt free, non-invasive anchoring compression seal. Resistant to UV, ozone, acid rain, wind driven rain and extreme temperatures.
 - 2. Basis-of-Design: MM Systems Corp., Model SIF Series, or approved equal.
 - 3. Joint Movement Capability: Plus and minus 50 percent of joint.
 - 4. Joint Width: Varies, as indicated on Drawings.
 - 5. Material: Foam sealant with Silicone bellows.
 - 6. Joint Seal Color: As selected by Architect from full range of manufacturer's colors.
 - 7. Attachment Method: Precompressed.
 - a. Joint sizes under 4" adhered with pressure sensitive adhesive (1) sidewall and bead of accessory silicone. (1) sidewall

2.04 EXPANSION JOINT COVER ASSEMBLIES

- A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
 - 1. Joint Dimensions and Configurations: As indicated on drawings.
 - 2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
 - 3. Joint Cover Styles: As indicated on drawings.
 - 4. Joint Movement Capability: If not indicated, provide minimum plus/minus 25 percent joint movement capability.
 - 5. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
 - 6. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

2.05 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
- B. Anchors and Fasteners: As recommended by cover manufacturer.
- C. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.
- B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

3.02 INSTALLATION

- A. Install components and accessories in accordance with manufacturer's instructions.
- B. Align work plumb and level, flush with adjacent surfaces.
- C. Rigidly anchor to substrate to prevent misalignment.
- D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer before installing compression seals.
- E. Terminate exposed ends of joint assemblies with field- or factory-fabricated termination devices.

END OF SECTION

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**SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES**

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 and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
2. Division 01 Section "General Conditions".
3. Division 08 Section "Flush Wood Doors".
4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
5. Division 08 Section "Fire-Rated Glazing" for fire-rated glazing units.
6. Division 08 Section "Door Hardware".
7. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. 10. SDI-113 Standard Practice for Determining the Steady-State Thermal Transmittance of Steel Door & Frame Assemblies.
10. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
11. ASTM C1199 - Standard Test Method for Measuring the Steady-State Thermal Transmittance of Fenestration Systems Using Hot Box Methods
12. ASTM E1423 - Practice for Determining Steady State Thermal Transmittance of Fenestration Systems.
13. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.

14. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
15. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
16. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
17. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
18. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
19. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 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 anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. 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 UL10C (neutral pressure at 40" above sill) or UL 10C.
 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 3. Smoke Control Door Assemblies: Comply with NFPA 105.

- a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
 - D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
 - E. Storm Shelter Openings: Provide complete door systems for hurricane or tornado storm shelters, and other areas of refuge, complying and tested according to ICC 500 (2014/2020), ICC/NSSA Standard for the Design and Construction of Storm Shelters.
 - 1. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
 - F. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
 - B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
 - C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.
- 1.6 PROJECT CONDITIONS
- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.
- 1.7 COORDINATION
- A. Coordinate installation of anchorages 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. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.
- 1.8 WARRANTY
- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's thermally enhanced QMax core. Where indicated provide doors fabricated as thermal-rated assemblies with a minimum thermal rating of 0.35 BTU/hr-ft²-F.
 - 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 - 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 - 5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 - 6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.

- a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
 5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. Manufacturers Basis of Design:
1. CECO Door Products (C) Polystyrene Core - Legion Series.
 2. Curries Company (CU) - Polystyrene Core - 707 Series.
 3. Curries Company (CU) - QMax Core - 707 Series.

2.4 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16" positive thermal break and integral vinyl weatherstripping.
- C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 2. Manufacturers Basis of Design:
 - a. Curries Company (CU) - M Series.
 - b. Curries Company (CU) - Mercury 3 Thermal Break TQ Series.
- D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 2. Manufacturers Basis of Design:
 - a. Curries Company (CU) - M Series.
- E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated

- or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
- 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
- 3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.
- 2.6 LIGHT OPENINGS AND GLAZING
 - A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
 - B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
 - C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
 - D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.
- 2.7 ACCESSORIES
 - A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
 - B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.
- 2.8 FABRICATION
 - A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
 - B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
 - C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" 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.
 - 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
 - D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
 3. Sidelight 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 butt welding.
 4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
 6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
 7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
 8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 9. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on-center and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
 10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
 11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door

Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.9 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

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. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.
- E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
- 3.4 ADJUSTING AND CLEANING
- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
 - B. Remove grout and other bonding material from hollow metal work immediately after installation.
 - C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.
- 3.5 FIELD QUALITY CONTROL
- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION

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**SECTION 08 1416
FLUSH WOOD DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush five-ply wood doors; flush and flush glazed configuration; non-rated.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 08 1113 - Hollow Metal Doors and Frames.
- C. Section 08 7100 - Door Hardware.
- D. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

- A. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- B. ANSI A208.1 - American National Standard for Particleboard; 2022.
- C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.
- D. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Samples: Submit two samples of door veneer, 4 by 4 inches (101.6 by 101.6 mm) in size illustrating wood grain, stain color, and sheen.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- F. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.
 - 1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Oshkosh Door Company.
 - 2. Masonite Architectural - Aspiro.
 - 3. VT Industries, Inc.

2.02 DOORS AND PANELS

- A. Doors: See drawings for locations and additional requirements.
 - 1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with WDMA I.S. 1A.
 - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Wood veneer facing with factory transparent finish as indicated on drawings.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Red oak,(to match existing) veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
 - 1. Vertical Edges: Same species as face veneer.
 - 2. "Running Match" each pair of doors and doors in close proximity to each other.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge for hardware reinforcement.
 - 2. Provide solid blocking for other throughbolted hardware.
- C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
 - 1. Transparent:
 - a. System - TR-2, Catalyzed Lacquer.
 - b. Stain: As selected by Architect.
 - c. Sheen: Satin.
- B. Factory finish doors in accordance with approved sample.
- C. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

- A. Door Hardware: See Section 08 7100
- B. Glazing: See Section 08 8000.
- C. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

END OF SECTION

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**SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Entrance doors.
- C. Weatherstripping.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- D. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum; 2025.
- C. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.
- D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- G. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).
- I. FLA (PAD) - Florida Building Code Online - Product Approval Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

- D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Specimen warranty.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.
 - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
 - a. Insulating Glass Certification Council (IGCC).
 - b. Safety Glazing Certification Council (SGCC).
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Aluminum-Framed Storefronts:
 - 1. Kawneer North America (Basis-of Design):
 - 2. Oldcastle BuildingEnvelope
 - 3. YKK AP America, Inc
- B. Entrance Doors Systems:
 - 1. Same manufacturer's as Aluminum-Framed Storefronts.

2.02 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING (EXTERIOR LOCATIONS)

- A. Front-Set Style, Structural Sealant Glazed Verticals, Thermally-Broken:
 - 1. Basis of Design: Kawneer- Trifab VersaGlaze 451T Framing System.

2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep (51 mm wide by 114 mm deep).

2.03 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING (INTERIOR LOCATIONS)

- A. Center-Set Style, Structural Sealant Glazed Verticals:
 1. Basis of Design: Kawneer- Trifab VersaGlaze 450- 2 inch sightline.
 2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep (51 mm wide by 114 mm deep).

2.04 BASIS OF DESIGN -- SWINGING DOORS

- A. Narrow Stile, Insulating Glazing, Thermally-Broken (Door 104.2, Conference Room only):
 1. Basis of Design: Kawneer- 250T Insulpour Thermal Entrances.
 2. Thickness: 2-1/4 inches (57.1 mm).
 3. Top Rail: 2 15/16 inches.
 4. Vertical Stiles: 2 1/2 inches.
 5. Bottom Rail: 3 7/8" inches.
 6. Glazing Stops: Beveled.
 7. Finish: Same as storefront.
- B. Medium Stile, Monolithic Glazing (Door #100, Vestibule):
 1. Basis of Design: Kawneer- 350 Standard Entrances Medium Stile.
 2. Thickness: Match Existing.
 3. Top Rail: 3 1/2 inches.
 4. Vertical Stiles: 3 1/2 inches.
 5. Bottom Rail: 6 1/2" inches.
 6. Glazing Stops: Beveled.
 7. Finish: Same as storefront.
- C. Medium Stile, Insulating Glazing, Thermally-Broken (All other locations):
 1. Basis of Design: Kawneer- 350T Insulpour Thermal Entrances.
 2. Thickness: 2-1/4 inches (57.1 mm).
 3. Top Rail: 3 1/2 inches.
 4. Vertical Stiles: 3 1/2 inches.
 5. Bottom Rail: 6 1/2" inches.
 6. Glazing Stops: Beveled.
 7. Finish: Same as storefront.

2.05 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 1. Glazing Rabbet: For 1 inch (25 mm) insulating glazing. (Exterior locations)
 2. Glazing Rabbet: For 3/8" inch (9.52 mm) monolithic glazing. (Interior at Reception Desk)
 3. Finish: Class I natural anodized.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Performance Requirements
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
 2. Wind-Borne-Debris Resistance: Identical full-size glazed assembly without auxiliary protection, having Florida Building Code FLA (PAD) approval for Large and Small Missile impact and pressure cycling at design wind pressure.
 3. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf (75 Pa) pressure difference.
 4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
 5. Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F) (____ W/(sq m K)), maximum.

2.06 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
1. Glazing Stops: Flush.
- B. Glazing: See Section 08 8000.

2.07 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.08 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
- B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.09 HARDWARE

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Other Door Hardware: See Section 08 7100 Door Hardware.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.
- E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Set thresholds in bed of sealant and secure.
- J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.06 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

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**SECTION 08 7100
DOOR HARDWARE**

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 commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Automatic operators.
 - 4. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
 - 2. Division 08 Section "Hollow Metal Doors and Frames".
 - 3. Division 08 Section "Flush Wood Doors".
 - 4. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
 - 8. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series.
 - 2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
 - 3. ANSI/UL 294 - Access Control System Units.
 - 4. UL 305 - Panic Hardware.
 - 5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
 - 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
- B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 1. Function of building, purpose of each area and degree of security required.
 2. Plans for existing and future key system expansion.
 3. Requirements for key control storage and software.
 4. Installation of permanent keys, cylinder cores and software.
 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 1. Structural failures including excessive deflection, cracking, or breakage.
 2. Faulty operation of the hardware.
 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.2 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
 5. Manufacturers:
 - a. Hager Companies (HA) - BB Series, 5-knuckle.
 - b. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.3 CONTINUOUS HINGES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 1. Where specified, provide modular continuous geared hinges that ship in two or three pieces and form a single continuous hinge upon installation.
 2. Manufacturers:
 - a. Hager Companies (HA).
 - b. Pemko (PE).
 - c. dormakaba BEST (ST).

2.4 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
1. Manufacturers:
 - a. Pemko (PE) - EL-CEPT Series.
 - b. Securitron (SU) - EL-CEPT Series.
 - c. dormakaba BEST (ST) EPT-12C Series.
 - B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
 1. Provide one each of the following tools as part of the base bid contract:
 - a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
 - b. McKinney (MK) - Connector Hand Tool: QC-R003.
 2. Manufacturers:
 - a. Hager Companies (HA) - Quick Connect.
 - b. McKinney (MK) - QC-C Series.
 - c. dormakaba BEST (ST) - WH Series.

2.5 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 2. Furnish dust proof strikes for bottom bolts.
 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 5. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Door Controls International (DC).
 - c. Rockwood (RO).
- B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
1. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Door Controls International (DC).
 - c. Rockwood (RO).

- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 4. Pulls, where applicable, shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
 - 5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
 - 6. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Hiawatha, Inc. (HI).
 - c. Rockwood (RO).

2.6 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 - 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 - 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 - 4. Tubular deadlocks and other auxiliary locks.
 - 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 6. Keyway: Match Facility Standard.
- C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- E. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Two (2)
 - 2. Master Keys (per Master Key Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
- F. Construction Keying: Provide construction master keyed cylinders.
- G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.7 MORTISE LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.
1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ML2000 Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.

2.8 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 4. Dustproof Strikes: BHMA A156.16.

2.9 ELECTRIC STRIKES

- A. Standard Electric Strikes: Electric strikes conforming to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be of stainless steel construction tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 1 million operating cycles. Provide strikes with 12 or 24 VDC capability, fail-secure unless otherwise specified. Where specified provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.
1. Manufacturers:
 - a. HES (HS) - 1500/1600 Series.
- B. Surface Mounted Rim Electric Strikes: Surface mounted rim exit device electric strikes conforming to ANSI/BHMA A156.31, Grade 1, and UL Listed for both Burglary Resistance and for use on fire rated door assemblies. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike. Strike requires no cutting to the jamb prior to installation.
1. Manufacturers:
 - a. HES (HS) - 9400/9500/9600/9700/9800 Series.

- C. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.10 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 - 1. Exit devices shall have a five-year warranty.
 - 2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 - 3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 - 4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 - 5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 - 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 - 7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 - 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 - 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 - 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 - 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
 - 1. Electromechanical exit devices shall have the following functions and features:
 - a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
 - b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
 - c. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
 - d. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.
 - e. Five-year limited warranty for electromechanical features.
 - 2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. dormakaba BEST (PR) - Apex 2000 Series.

2.11 SURFACE DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Heavy duty surface mounted door closers shall have a 30-year warranty.
 2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC6000 Series.
 - b. Norton Rixson (NO) - 7500 Series.
 - c. Sargent Manufacturing (SA) - 351 Series.

2.12 ELECTROHYDRAULIC DOOR OPERATORS

- A. Electrohydraulic Door Operators (High Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that meet ANSI/BHMA A156.4 requirements and are UL listed for use on fire rated doors and UL10C certified that comply with requirements for the Americans with Disabilities Act (ADA). Operators shall be verified by GreenCircle to offer energy savings of 19% when compared to similar products to accommodate openings up 250 pounds and 48" wide.
1. Provide operators with features as follows:
 - a. Non-handed with push and pull side mounting.
 - b. Operates as mechanical surface closer during close cycles, when door is opened manually or if power is off.
 - c. Activation by push button, hands-free or radio frequency devices.
 - d. On board electronics to collect usage and cycle count data to facilitate preventative maintenance/diagnostics.
 - e. Two-year limited warranty.
 - f. Wi-Fi interface where the operator is a secure, password protected WiFi hot spot with no connection to building's IT required.
 - g. Simple setup with no app required.
 - h. View status and make adjustments without removing the cover.
 - i. Built-in logic to support single use restroom applications with no external relay boards, logic modules, position switches required.

- j. Mounting backplate to simplify and speed up installation.
- 2. Operators shall have the following functionality:
 - a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.
 - b. Blow Open for Smoke Ventilation: Door opens when signal is received from alarm system allowing air or smoke to flow through opening. Door will stay open until signal from alarm system is stopped.
 - c. Infinite Hold Open: Door will hold open at set position until power is turned off.
 - d. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
 - e. Open Delay: Delays operator opening for locking hardware.
 - f. Overload Safety Shut-Off: After two minutes of receiving a door activation signal, inverter times out and door closes to prevent motor/inverter damage.
 - g. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
 - h. Push & Go: As the door is manually opened, the operator "senses" movement and opens door to the full-open position.
 - i. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.
 - j. Vestibule Delay: When the wall switch is pressed, first door in vestibule will open. Second door will open once vestibule door delay has expired. Delay is adjustable.
- 3. Manufacturers:
 - a. Norton Rixson (NO) - 6000 Series.

2.13 ARCHITECTURAL TRIM

A. Door Protective Trim

- 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
- 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
- 3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
- 4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, .050-inch thick.
- 5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
- 6. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Hiawatha, Inc. (HI).
 - c. Rockwood (RO).

2.14 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 - 1. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Hiawatha, Inc. (HI).
 - c. Rockwood (RO).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 - 1. Manufacturers:
 - a. Norton Rixson (RF).
 - b. Rockwood (RO).
 - c. Sargent Manufacturing (SA).

2.15 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 - 1. National Guard Products (NG).
 - 2. Pemko (PE).
 - 3. Reese Enterprises, Inc. (RE).

2.16 ELECTRONIC ACCESSORIES

- A. Touchless Switches: FCC certified microwave sensing switch used for REX or activation of various access control devices in place of a traditional wired switch. Unit to have an adjustable

sensing zone from 4" to 24". At exterior locations furnish foam gaskets and weather covers. Provide single gang or double gang unit as specified in the hardware sets.

1. Manufacturers:

- a. Alarm Controls (AK) - NTS Series.
- b. Norton Rixson (NO) - 700 Series.
- c. Securitron (SU) - WSS Series.

B. Request to Exit Motion Sensor: Passive infrared request to exit (REX) motion sensor designed for detecting exiting through a door from the secure area to a non-secure area.

1. Provide devices with functions and features as follows:

- a. Adjustable infrared beam and relock time.
- b. UL listed.
- c. 12VDC or 24VDC power.
- d. Single pole, double throw (SPDT) switch.

2. Manufacturers:

- a. Alarm Controls (AK) - SREX Series.
- b. Securitron (SU) - XMS2 Series.

C. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

- a. Securitron (SU) - DPS Series.

2.17 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.18 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

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. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handing and sizing all products.
 - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
 - 4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SU - Securitron
4. RO - Rockwood
5. SA - SARGENT
6. RU - Corbin Russwin
7. HS - HES
8. RF - Rixson
9. NO - Norton
10. HD - HID
11. OT - Other
12. AK - Alarm Controls

Hardware Sets

Set: 1.0

Doors: 100

Description: CVR x NL/EO x ELR, Clo x OH, Pair No Mullion, Ext, Alum

2 Continuous Hinge x EPT (AL)	CFM SLF-HD1 PT x Dr Ht		PE
2 Electric Power Transfer	EL-CEPT	630	SU
1 CVR Exit (exit only, ELR, RX, narrow)		43 55 56 AD8410	
US32D	SA		
1 CVR Exit (NL, ELR, RX, narrow)	43 55 56 AD8410 x 106	US32D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
2 Offset Pull (Grip Zone)	RM3411-36	US32	RO
2 Conc Overhead Stop	1-X36	630	RF
2 Closer - Top Jamb	J7500	689	NO
2 Brush Sweep	18061CNB		PE
1 Threshold - 5" T-Break	252x3AFG		PE
2 E-Lynx Harness (Frame)	QC-C3000P		MK
2 E-Lynx Harness (Door)	QC-C*** (length / type as req'd)		MK
1 Card Reader	By Security Contractor	BLK	HD
1 Wiring Diagram	Elevation & Point to Point		OT
2 Door Position Switch	DPS-M / W-GY (as req'd)		SU

Notes: WIDE STILE EXIT DEVICES ACCEPTABLE WHERE THEY WILL FIT

-Weatherstripping/Door edge gasketing furnished by Aluminum Door/Frame supplier.

-Furnish all necessary brackets/spacers and plates necessary for a complete and proper installation of hardware items listed.

Doors normally closed and locked.

Valid card read retracts latch on active leaf for entry. Key override available.

Doors can be unlocked on a time schedule set in EAC system, to act as push/pull.

Door position switch indicates door status.

REX switch in push bar signals authorized egress.

Free egress at all times.

Set: 2.0

Doors: 118.2

Description: Card Reader x Electric Strike, Rim Exit x Pull, Closer, OH Stop, Ext, Alum

1 Continuous Hinge (AL)	CFM SLF-HD1-M x Dr Ht		PE
1 Rim Exit (NL, narrow)	43 AD8504 Less Pull	US32D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Electric Strike	9600	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Offset Pull	RM201	US32D	RO
1 Conc Overhead Stop	1-X36	630	RF
1 Closer - Top Jamb	J7500	689	NO
1 Brush Sweep	18061CNB		PE
1 Threshold - 5" T-Break	252x3AFG		PE
1 E-Lynx Harness (Frame)	QC-C3000P		MK
1 Card Reader	By Security Contractor	BLK	HD
1 Door Position Switch	DPS-M / W-GY (as req'd)		SU
1 Motion Sensor REX	XMS		SU

Notes: WIDE STILE EXIT DEVICES ACCEPTABLE WHERE THEY WILL FIT

-Weatherstripping/Door edge gasketing furnished by Aluminum Door/Frame supplier.

-Furnish all necessary brackets/spacers and plates necessary for a complete and proper installation of hardware items listed.

Door normally closed and locked.

Valid card read unlocks electric strike for entry. Key override available.

Door can be unlocked on a time schedule set in EAC system, to act as push/pull.

Door position switch indicates door status.

Motion REX above door signals authorized egress.

Free egress at all times.

Set: 3.0

Doors: C108.1

Description: Rim x NL x Pull, Clo x OH, Ext, Alum

1 Continuous Hinge (AL)	CFM SLF-HD1-M x Dr Ht		PE
1 Rim Exit (NL, narrow)	43 AD8504 Less Pull	US32D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Offset Pull	RM201	US32D	RO
1 Conc Overhead Stop	1-X36	630	RF
1 Closer - Top Jamb	J7500	689	NO
1 Brush Sweep	18061CNB		PE
1 Threshold - 5" T-Break	252x3AFG		PE
1 Door Position Switch	DPS-M / W-GY (as req'd)		SU

Notes: WIDE STILE EXIT DEVICES ACCEPTABLE WHERE THEY WILL FIT

-Weatherstripping/Door edge gasketing furnished by Aluminum Door/Frame supplier.

-Furnish all necessary brackets/spacers and plates necessary for a complete and proper installation of hardware items listed.

Door position switch indicates door status.

Set: 4.0

Doors: 104.2

Description: Rim x NL x Pull, Clo x OH, Ext, Alum

1 Continuous Hinge (AL)	CFM SLF-HD1-M x Dr Ht		PE
1 Rim Exit (NL, narrow)	43 AD8504 Less Pull	US32D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Conc Overhead Stop	1-X36	630	RF
1 Closer - Top Jamb	J7500	689	NO
1 Brush Sweep	18061CNB		PE
1 Threshold - 5" T-Break	252x3AFG		PE
1 Door Position Switch	DPS-M / W-GY (as req'd)		SU

Notes: WIDE STILE EXIT DEVICES ACCEPTABLE WHERE THEY WILL FIT

-Weatherstripping/Door edge gasketing furnished by Aluminum Door/Frame supplier.

-Furnish all necessary brackets/spacers and plates necessary for a complete and proper installation of hardware items listed.

Door position switch indicates door status.

Set: 5.0

Doors: C111

Description: Rim x EO, Clo x OH, Ext, HM

1 Continuous Hinge (WD/HM)	CFM HD1-M x Dr Ht		PE
1 Rim Exit (exit only)	43 8810 EO	US32D	SA
1 Conc Overhead Stop	1-X36	630	RF
1 Closer - PA	PR7500	689	NO
1 Rain Guard	346C (frame width)		PE
1 Gasketing	2891AS (head/jamb)		PE
1 Brush Sweep	18061CNB		PE
1 Threshold - 6" T-Break	253x3AFG		PE
1 Door Position Switch	DPS-M / W-GY (as req'd)		SU

Notes:

Install gasketing before closer and rim exit strike.

Door position switch indicates door status.

Set: 6.0

Doors: 105.2, 129

Description: Storeroom, Closer/Stop/HO, Pair, Ext

2 Continuous Hinge (WD/HM)	CFM HD1-M x Dr Ht		PE
2 Manual Flush Bolt	555/557 (as req'd)	US26D	RO
1 Storeroom Lock	8204 LNJ (SPAR 09224)	US26D	SA
2 Closer x Stop/HO	CLP7500T	689	NO
2 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 T-Astragal	355CS x Dr Ht		PE
1 Gasketing	2891AS (head)		PE
2 Gasketing	290AS (jamb)		PE
2 Brush Sweep	18061CNB		PE
1 Threshold - Panic	2009APK		PE
2 Door Position Switch	DPS-M / W-GY (as req'd)		SU

Notes: Install gasketing at head before installing closer(s).

Door position switch indicates door status.

Set: 7.0

Doors: [132.2](#)

Description: Passage Lever x Rim Exit, Closer/Stop, Rated

3 Hinge (heavy weight)	T4A3786 (NRP) - USA	US26D	MK
1 Rim Exit (passage)	43 8815 ETJ x 626 (SPAR 09225)	US32D	SA
1 Closer x Stop	CLP7500	689	NO
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 Perimeter Gasketing	S88BL (head & jambs)		PE

Set: 8.0

Doors: 112

Description: Card Reader x Electric Strike

3 Hinge	Re-Use Existing	US26D	MK
1 Storeroom Lock	8204 LNJ	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Electric Strike	1500C	630	HS
1 Closer	PR7500 / Reg 7500 (as req'd)	689	NO
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 Stop	406 / 409 / 441	US26D	RO
1 E-Lynx Harness (Frame)	QC-C3000P		MK
1 Card Reader	By Security Contractor	BLK	HD

Notes:

Door normally closed and locked.

Valid card read unlocks electric strike for entry.

Key override available.

Free egress at all times.

Set: 9.0

Doors: [C108.2](#), [C108.4](#)

Description: Storeroom, OHx2, MFB's

6 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Manual Flush Bolt	555/557 (as req'd)	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Storeroom Lock	8204 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
2 Surf Overhead Stop	10-X36	630	RF

Set: 10.0

Doors: [008.1](#)

Description: Storeroom

3 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Storeroom Lock	8204 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 Stop	406 / 409 / 441	US26D	RO

Set: 11.0

Doors: 007, 008.2

Description: Storeroom, OH Stop

3 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Storeroom Lock	8204 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 Surf Overhead Stop	10-X36	630	RF

Set: 12.0

Doors: 009.1

Description: Storeroom, Closer

3 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Storeroom Lock	8204 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Closer	PR7500 / Reg 7500 (as req'd)	689	NO
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 Stop	406 / 409 / 441	US26D	RO

Set: 13.0

Doors: 105.1

Description: Storeroom, Closer, Surface OH Stop

3 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Storeroom Lock	8204 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Surf Overhead Stop	10-X36	630	RF
1 Closer	PR7500 / Reg 7500 (as req'd)	689	NO
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO

Set: 14.0

Doors: 133, 137

Description: Keypad Mortise Lock, Closer (#133 Rated)

3 Hinge (heavy weight)	T4A3786 (NRP) - USA	US26D	MK
1 Keypad Mortise Lock	KP8276 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Closer - Reg Arm	7500	689	NO
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 Stop	406 / 409 / 441	US26D	RO

Notes:

Door normally closed and locked.
Valid PIN unlocks lever for entry.
Key override available.
Free egress at all times.

Set: 15.0

Doors: 104.1, 107, 108, 109, 110, 116

Description: Office

3 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Office Lock	8205 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Stop	406 / 409 / 441	US26D	RO

Set: 16.0

Doors: 106, 136

Description: Office, Surface OH Stop

3 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Office Lock	8205 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Surf Overhead Stop	10-X36	630	RF

Set: 17.0

Doors: 134

Description: Classroom, CLFB, Unequal Pair

6 Hinge	TA2714 (NRP) - USA	US26D	MK
1 C/L Flush Bolt (top only, HM)	2805	US26D	RO
1 Classroom Lock	8237 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
2 Stop	406 / 409 / 441	US26D	RO

Set: 18.0

Doors: 005, 111

Description: Classroom, OHx2, MFB, Pair

6 Hinge	TA2714 (NRP) - USA	US26D	MK
2 Manual Flush Bolt	555/557 (as req'd)	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Classroom Lock	8237 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
2 Surf Overhead Stop	10-X36	630	RF

Set: 19.0

Doors: [C105](#)

Description: Classroom, Electric Strike, AOx1, Closer, AFB, Unequal Pair, Rated

6 Hinge (heavy weight)	T4A3786 (NRP) - USA	US26D	MK
1 Electric Power Transfer	EL-CEPT	630	SU
1 Auto Flush Bolt Set	2842/2942 (as req'd)	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Classroom Lock	8237 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Electric Strike	1500C	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Coordinator	2600 Series x FB x Wear Plates	Black	RO
2 Mounting Bracket	2601AB/C	Black	RO
1 Closer	PR7500 / Reg 7500 (as req'd)	689	NO
1 Automatic Operator	6011 / 6061 (as req'd)	689	NO
2 Kick Plate	K1050 10" 4BE CSK	US32D	RO
2 Stop	406 / 409 / 441	US26D	RO
1 Astragal Edge Seal	S772BL x Dr Ht		PE
1 Perimeter Gasketing	S88BL (head & jambs)		PE
1 Actuator Button	505		NO
1 Touchless Actuator	NTS-1		AK

Notes:

Door normally closed and latched.

Touchless actuator one side or push button actuator on other side unlocks electric strike then opens door automatically.

Free mechanical egress at all times.

Set: 20.0

Doors: [128](#)

Description: Classroom

3 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Classroom Lock	8237 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Stop	406 / 409 / 441	US26D	RO

Set: 21.0

Doors: [011](#), [123](#)

Description: Classroom, Wet Area

3 Hinge	TA2314 (NRP) - USA	US32D	MK
1 Classroom Lock	8237 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Stop	406 / 409 / 441	US26D	RO

Set: 22.0

Doors: [004](#), [126](#)

Description: Classroom, OH Stop

3 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Classroom Lock	8237 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 Surf Overhead Stop	10-X36	630	RF

Set: 23.0

Doors: [122](#)

Description: Classroom, Closer

3 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Classroom Lock	8237 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Closer	PR7500 / Reg 7500 (as req'd)	689	NO
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 Stop	406 / 409 / 441	US26D	RO

Set: 24.0

Doors: [003](#), [120](#), [121](#), [124](#), [125](#), [127](#)

Description: Classroom, Closer x OH Stop

3 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Classroom Lock	8237 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Surf Overhead Stop	10-X36	630	RF
1 Closer	PR7500 / Reg 7500 (as req'd)	689	NO
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO

Set: 25.0

Doors: [130](#)

Description: Classroom, Rated

3 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Classroom Lock	8237 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Closer	PR7500 / Reg 7500 (as req'd)	689	NO
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 Stop	406 / 409 / 441	US26D	RO
1 Perimeter Gasketing	S88BL (head & jambs)		PE

Set: 26.0

Doors: [012](#)

Description: Privacy Restroom

3 Hinge	TA2314 (NRP) - USA	US32D	MK
1 Privacy Set (OCC/VAC)	V21 8265 LNJ (SPAR 09224)	US26D	SA
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 Mop Plate	K1050 4" 4BE CSK	US32D	RO
1 Stop	406 / 409 / 441	US26D	RO

Set: 27.0

Doors: [115](#)

Description: Keyed Privacy

3 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Keyed Privacy Lock (OCC/VAC)	V21 8267 LNJ (SPAR 09224)	US26D	SA
1 Cylinder	Size, Cam, Keyway As Req'd	626	RU
1 Stop	406 / 409 / 441	US26D	RO

Set: 28.0

Doors: 010

Description: Passage

3 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Passage Set	8215 LNJ (SPAR 09224)	US26D	SA
1 Stop	406 / 409 / 441	US26D	RO

Set: 29.0

Doors: S101

Description: Passage, Closer/Stop, Rated

3 Hinge	TA2714 (NRP) - USA	US26D	MK
1 Passage Set	8215 LNJ (SPAR 09224)	US26D	SA
1 Closer x Stop	CLP7500	689	NO
1 Kick Plate	K1050 10" 4BE CSK	US32D	RO
1 Perimeter Gasketing	S88BL (head & jambs)		PE

Set: 30.0

Doors: 001, 002, 006.1, 006.2, S001, S002, 101, 102, 103, 113, 114, 117, 118.1, 132.1, 132.4, 135, 138, 139

Description: Existing Hardware to Remain

1 Existing Hardware	Re-Use All Existing Hardware	OT

Set: 31.0

Doors: 131

Description: All Hardware By Door Mfr.

1 All Hardware	By Door Manufacturer	OT

END OF SECTION

**SECTION 08 8000
GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.
- C. Plastic sheet glazing units.
- D. Glazing compounds.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.
- C. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- D. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.
- E. Section 08 4313 - Aluminum-Framed Storefronts
- F. Section 08 8813 - Fire-Rated Glazing.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- E. ASTM C1036 - Standard Specification for Flat Glass; 2025.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.
- G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.
- H. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
- J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
- L. GANA (SM) - GANA Sealant Manual; 2008.
- M. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.
- N. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.
- O. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.
- P. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit, Glazing Unit, and Spandrel Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 12 by 12 inch (304 by 304 mm) in size of glass units.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.

1.07 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 3. Glass thicknesses listed are minimum.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
 - 1. In conjunction with weather barrier related materials described in other sections, as follows:
 - a. Vapor Retarders: See Section 07 2600.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.

2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.02 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
 3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
 4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
 1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.03 INSULATING GLASS UNITS

- A. Manufacturers:
 1. Guardian Glass, LLC.
 2. Pilkington North America Inc.
 3. Vitro Architectural Glass (formerly PPG Glass).
- B. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
- C. Insulating Glass Units: Types as indicated.
 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Metal-Edge Spacers: Aluminum, bent and soldered corners.
 4. Spacer Color: Black.
 5. Edge Seal:
 - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
 - b. Color: Black.
 6. Purge interpane space with dry air, hermetically sealed.
- D. Type IG - Insulating Glass Units: Vision glass, double glazed.
 1. Basis-of-design: Vitro Solarbarn R100
 2. Applications: Exterior glazing unless otherwise indicated.
 3. Space between lites filled with argon.
 4. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Tint: As selected by Architect from manufacturer's full range.
 5. Metal edge spacer.
 6. Inboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Tint: Gray.
 - b. Coating: Low-E, Pyrolytic or sputtered, on #3 surface.
 7. Total Thickness: 1 inch (25.4 mm).
 8. Thermal Transmittance (U-Value), Summer Daytime/Winter Nighttime: 0.25, nominal.
 9. Visible Light Transmittance (VLT): 43 percent, nominal.
 10. Solar Heat Gain Coefficient (SHGC): 0.23, nominal.
 11. Visible Light Reflectance, Outside: 33 percent, nominal.
 12. Glazing Method: Dry glazing method, gasket glazing.

- E. Type S - Insulating Glass Units: Spandrel glazing.
 - 1. Applications: Exterior spandrel glazing unless otherwise indicated.
 - 2. Space between lites filled with air.
 - 3. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Tint: Gray.
 - b. Coating: Same as on vision units, on #2 surface.
 - 4. Metal edge spacer.
 - 5. Inboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick.
 - a. Tint: Clear.
 - b. Opacifier: Ceramic frit, on #4 surface.
 - c. Opacifier Color: As selected from manufacturer's full range..
 - 6. Total Thickness: 1 inch (25.4 mm).
- F. Type IT - Insulating Glass Units: Safety glazing.
 - 1. Applications:
 - a. Glazed lites in exterior doors.
 - b. Glazed sidelights and panels next to doors.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - 2. Space between lites filled with argon.
 - 3. Glass Type: Same as Type IG except use fully tempered float glass for both outboard and inboard lites.
 - 4. Tint: Gray.
 - 5. Total Thickness: 1 inch (25.4 mm).
 - 6. Thermal Transmittance (U-Value), Summer Daytime/Winter Nighttime: 0.25, nominal.
 - 7. Solar Heat Gain Coefficient (SHGC): 0.23, nominal.

2.04 GLAZING UNITS

- A. Type T - Monolithic Safety Glazing: Non-fire-rated.
 - 1. Applications:
 - a. Glazed lites in doors, except fire doors.
 - b. Glazed sidelights to doors, except in fire-rated walls and partitions.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on drawings.
 - 2. Glass Type: Fully tempered safety glass as specified.
 - 3. Tint: Clear.
 - 4. Thickness: 1/4 inch (6.4 mm), nominal.
- B. Type L - Laminated Safety Glazing: Laminated glass, 2-Ply. (Interior Sloped Glazing)
 - 1. Applications: Sloped Locations as indicated on drawings.
 - 2. Tint: Clear.
 - 3. Thickness: As required to meet performance criteria.
 - 4. Outer Lite: Tempered glass.
 - 5. Interlayer: Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
 - 6. Inside Lite: Tempered glass.
- C. Type GLS1 - Colored Monolithic Safety Glazing: Non-fire-rated (Reception Area)
 - 1. Basis-of-Design: 3Form Glass, or approved equal.
 - 2. Glass Type: Fully tempered safety glass as specified.
 - 3. Tint/Color: as indicated on Drawings
 - 4. Thickness: 3/8 inch (9.5 mm), nominal.

2.05 PLASTIC SHEET GLAZING UNITS

- A. Type PNL1 - Resin Material Sheet (Reception Area):
 - 1. Basis-of-Design: 3Form Varia, or approved equal.

2. Applications: Locations as indicated on drawings.
3. Type: Monolithic (single layer solid) sheet. Refer to drawings.
4. Silicone abrasion resistant coating for scratch resistance.
5. Tint: colored with pattern.
6. Thickness: 0.397 inch (10 mm).
7. Width: 48 inch (1220 mm).

2.06 GLAZING COMPOUNDS

- A. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.07 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.
- B. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- C. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- B. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove nonpermanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

**SECTION 08 8813
FIRE-RATED GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire-rated glazing units.
- B. Glazing compounds.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors, borrowed lites, and transoms.
- C. Section 08 800 - Glazing

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- H. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.
- I. GANA (GM) - GANA Glazing Manual; 2022.
- J. GANA (SM) - GANA Sealant Manual; 2008.
- K. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (Reaffirmed 2016).
- M. ITS (DIR) - Directory of Listed Products; Current Edition.
- N. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- O. NGA (LGRM) - Laminated Glazing Reference Manual; 2019.
- P. UL (DIR) - Online Certifications Directory; Current Edition.
- Q. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- R. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- S. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data on Glazing Unit Glazing Types: Provide structural, physical, and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with GANA (GM), GANA (SM), IGMA TM-3000, and NGA (LGRM) for glazing installation methods. Maintain one copy on site.

PART 2 PRODUCTS

2.01 GLASS MATERIALS

- A. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
 - 1. Laminated Safety Glass: Comply with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
 - 2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch (0.762 mm) thick, minimum.

2.02 GLAZING UNITS

- A. Type (F) - Fire-Resistance-Rated Glazing: Type, thickness, and configuration of glazing that contains flames, smoke, and blocks radiant heat, as required to achieve indicated fire rating period exceeding 45 minutes.
 - 1. Applications:
 - a. Glazing in fire-rated door assembly.
 - 2. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
 - 3. Safety Glazing Certification: 16 CFR 1201 Category II.
 - 4. Glazing Method: As required for fire rating.
 - 5. Fire Rating Period: 60 minutes.
 - 6. Markings for Fire-Resistance-Rated Glazing Assemblies: Provide permanent markings on fire-resistance-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction.
 - a. "W" - meets wall assembly criteria of ASTM E119 or UL 263 fire test standards.
 - b. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
 - c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire test standards.
 - d. "T" - meets temperature rise of not more than 450 degrees F (250 degrees C) above ambient at end of 30 minutes fire exposure in accordance with NFPA 252, UL 10B, or UL 10C fire test standards.
 - e. "XXX" - placeholder that represents fire rating period, in minutes.
 - 7. Products:
 - a. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite II-XLM 60:
 - b. Technical Glass Products; Pilkington Pyrostop 60.
 - c. Approved equal.

2.03 GLAZING COMPOUNDS

- A. Type GC-1 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.04 ACCESSORIES

- A. Setting Blocks: Aluminum silicate, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.
- B. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 INSTALLATION - GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers unless more stringent requirements are indicated, including those in referenced glazing standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with contaminating substances that may result from construction operations including, but not limited to weld spatter, fire-safing, plastering, mortar droppings, etc.

END OF SECTION

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**SECTION 09 0561
COMMON WORK RESULTS FOR FLOORING PREPARATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
 - 1. Resilient tile.
 - 2. Carpet tile.
- B. Removal of existing floor coverings.
- C. Preparation of new and existing concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).

1.02 REFERENCE STANDARDS

- A. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- B. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2018.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Visual Observation Report: For existing floor coverings to be removed.
- C. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.
- D. Adhesive Bond and Compatibility Test Report.
- E. Copy of RFCI (RWP).

1.04 QUALITY ASSURANCE

- A. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
 - 1. Preliminary cleaning.
 - 2. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
 - 3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.

5. Specified remediation, if required.
6. Patching, smoothing, and leveling, as required.
7. Other preparation specified.
8. Adhesive bond and compatibility test.
9. Protection.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

- A. Comply with local, State, and federal regulations and recommendations of RFCI (RWP), as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet (1.4 kg per 93 square meters) per 24 hours.
- F. Report: Report the information required by the test method.

3.04 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.05 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

END OF SECTION

**SECTION 09 2116
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Acoustic insulation (Sound-attenuation blankets).
- C. Interior gypsum board.
- D. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 06 1000 - Rough Carpentry: Sheathing for exterior walls.
- C. Section 07 2100 - Thermal Insulation: Thermal insulation.
- D. Section 07 2600 - Vapor Retarders: Vapor barrier for exterior walls.
- E. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- F. Section 09 2216 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

- A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- B. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2020).
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.
- E. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
- F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
- G. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- H. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.
- I. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
- L. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- M. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

- N. UL (DIR) - Online Certifications Directory; Current Edition.
- O. UL (FRD) - Fire Resistance Directory; Current Edition.
- P. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide data on gypsum board, accessories, and joint finishing system.
 - 2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.
- B. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
 - 1. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- C. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
 - 1. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

2.02 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. CertainTeed Corporation.
 - 2. Georgia-Pacific Gypsum.
 - 3. USG Corporation.
- B. Gypsum Board: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use Type X for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold resistant board is required as indicated on drawings.
 - 3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.

4. Thickness:
 - a. Vertical Surfaces: 5/8 inch (16 mm).

2.03 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation (Sound-Attenuation Blankets): ASTM C665; Type I, Class A, ASTM E84 - preformed mineral-fiber, friction fit type, unfaced; thickness as required for wall assembly and STC.
 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- B. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
 1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 2. Tape Thickness: 1/4 inch (6 mm).
- C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- D. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
 1. Trim Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 2. Expansion (control) Joints:
 - a. Fire-Resistance Rated: 1 hour when joint system tested in accordance with UL 2079.
 - b. Type: V-shaped metal with factory-installed protective tape.
- E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 1. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
 2. Joint Compound: Drying type, vinyl-based, ready-mixed.
 - a. For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
- F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.
- H. Nails for Attachment to Wood Members: ASTM C514.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.
- C. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.03 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board parallel to framing, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- E. Installation on Metal Framing: Use screws for attachment of gypsum board.
- F. Installation on Wood Framing: For nonrated assemblies, install as follows:
 - 1. Single-Layer Applications: Screw attachment.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
 - 2. At exterior soffits, not more than 30 feet (10 meters) apart in both directions.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.05 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 4. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
- D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.06 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.07 PROTECTION

- A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

**SECTION 09 2216
NON-STRUCTURAL METAL FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-load-bearing steel framing systems for interior partitions.
- B. Suspension systems for interior ceilings and soffits
- C. Framing accessories.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 05 4000 - Cold-Formed Metal Framing: Requirements for structural, load-bearing, metal stud framing and exterior wall stud framing.
- C. Section 07 8400 - Firestopping: Sealing top-of-wall assemblies at fire-resistance-rated walls.

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).
- B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- D. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.
- E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
- G. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.
- H. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.
- C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- D. Manufacturer Reports: Include research reports indicating compliance with applicable building codes for each type of product.

PART 2 PRODUCTS

2.01 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, according to 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, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- C. Horizontal Deflection: For composite and non-composite wall assemblies, limited to L/240 or L/360 to max. deflection of ½ inch. on horizontal loading of 5 lbf/sq. ft..
- D. Design Loads: 5 lb /sq. ft. minimum as required by the IBC.
- E. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of 1 inches in both the upward and downward direction.

2.02 FRAMING MATERIALS

- A. Firestopping: Materials meeting requirements necessary to maintain rating of penetrated assembly.
 - 1. See Section 07 8400.
 - 2. Fire Ratings: See drawings for required systems and ratings.
- B. Non-Loadbearing Framing System Components: AISI S220; sheet steel, of size and properties necessary for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).
 - 1. Studs: C-shaped.
 - a. Products:
 - 1) ClarkDietrich; ProSTUD.
 - 2) MarinoWARE; ViperStud Drywall Framing.
 - 3) MBA Building Supplies; ProSTUD.
 - b. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection.
 - c. Depth: As indicated on Drawings.
 - d. Spacing: As required by performance requirements for horizontal deflection.
 - 2. Runners: U-shaped, sized to match studs.
 - 3. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
 - 4. Resilient Furring Channels: Single or double leg configuration; 1/2 inch (12 mm) channel depth.
- C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
 - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code when evaluated in accordance with AISI S100.
 - 2. Material: ASTM A653/A653M steel sheet, SS Grade 50.
 - 3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
- D. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
- E. Non-Loadbearing Framing Accessories:
 - 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

2. Framing Connectors: ASTM A653/A653M steel clips; secures cold rolled channel to wall studs for lateral bracing.
3. Flexible Wood Backing: Fire-retardant-treated wood with sheet steel connectors.
4. Fasteners: ASTM C1002 self-piercing self-tapping screws.

2.03 FABRICATION

- A. Fabricate assemblies of framed sections to sizes and profiles required.
- B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

- A. Install non-structural members in accordance with ASTM C754.
- B. Extend partition framing to structure where indicated and to ceiling in other locations.
- C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- D. Align and secure top and bottom runners at 24 inches (600 mm) on center.
- E. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- F. Align stud web openings horizontally.
- G. Secure studs to tracks using crimping method. Do not weld.
- H. Fabricate corners using a minimum of three studs.
- I. Install double studs at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.
- J. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- K. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches (150 mm).

3.03 CEILING AND SOFFIT FRAMING

- A. Comply with requirements of ASTM C754.
- B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- C. Install furring independent of walls, columns, and above-ceiling work.
- D. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated.
- E. Space main carrying channels at maximum 72 inches (1 800 mm) on center, and not more than 6 inches (150 mm) from wall surfaces. Lap splice securely.
- F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- G. Place furring channels perpendicular to carrying channels, not more than 2 inches (50 mm) from perimeter walls, and rigidly secure. Lap splices securely.

3.04 TOLERANCES

- A. Maximum Variation From True Position: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation From Plumb: 1/8 inch in 10 feet (3 mm in 3 m).

END OF SECTION

**SECTION 09 5100
ACOUSTICAL CEILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- E. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.
- F. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Samples: Submit two samples 3 by 3 inch (76 by 76 mm) in size illustrating material and finish of acoustical units.
- D. Samples: Submit two samples each, 6 inches (152 mm) long, of suspension system main runner, cross runner, and perimeter molding.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 2 percent of total installed.

1.06 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc.
 - 2. Certainteed Architectural.
 - 3. USG Corporation.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
 - 1. Provide product type as indicated on the drawings.

2.03 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings and hold down clips as required.
 - 1. Materials:
 - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System: Hot-dipped galvanized steel grid with steel cap.
 - 1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 2. Profile: Tee; 15/16 inch (24 mm) face width.
 - 3. Finish: Baked enamel.
 - 4. Color: White.
 - 5. Products:
 - a. Armstrong World Industries, Inc; Prelude XL.

2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.106 inch (2.69 mm) galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application. Where indicated on the drawings.
- D. Perimeter Moldings: Same metal and finish as grid.
 - 1. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
 - 2. Channel Molding: U-shaped, for hold-down type installations.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.
- C. Layout openings for penetrations centered on penetrating items.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size unless otherwise indicated.
- D. Locate system on room axis according to reflected plan.
- E. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
- F. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- I. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
- J. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.
- F. Install hold-down clips on panels where indicated on the drawings.

3.05 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Clean surfaces.
- C. Replace damaged or abraded components.

END OF SECTION

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**SECTION 09 6500
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring - Solid Vinyl Tile (SVT).
- B. Resilient tile flooring - Luxury Vinyl Tile (LVT)
- C. Resilient base.
- D. Resilient stair accessories.
- E. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

1.03 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- C. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.
- D. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
- E. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015 (Reapproved 2020).
- F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Verification Samples: Submit two samples, 4 by 4 inch (101.6 by 101.6 mm) in size illustrating color and pattern for each resilient flooring product specified.
- D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Wall Base: 10 linear feet (3 linear meters) of each type and color.
 - 3. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing specified flooring with minimum 5 years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

1.07 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. Luxury Vinyl Tile (Type LVT 1, 2 & 3): Printed film type, with transparent or translucent wear layer.
 - 1. Manufacturers: Johnsonite Tarkett (Basis-of-Design) or approved equal.
 - 2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
 - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 - 4. Plank Tile Size: as indicated on the drawings.
 - 5. Wear Layer Thickness: 0.020 inch (0.50 mm).
 - 6. Total Thickness: 0.125 inch (3 mm).
 - 7. Color: As indicated on drawings.
- B. Solid Vinyl Tile (Type SVT-1): Homogeneous, with color extending throughout thickness.
 - 1. Manufacturers: Flexco Corporation (Basis-of-Design) or approved equal.
 - 2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
 - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 - 4. Plank Tile Size: as indicated on the drawings.
 - 5. Total Thickness: 0.125 inch (3 mm).
 - 6. Color: As indicated on drawings.

2.02 STAIR COVERING

- A. Stair Treads: (Type RT-1), Rubber; full width and depth of stair tread in one piece; tapered thickness.
 - 1. Manufacturers:
 - a. Flexco Corporation.
 - b. Roppe Corporation.
 - c. Johnsonite, a Tarkett Company, (Basis-of-Design).
 - 2. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
 - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 - 4. Nosing: Square.
 - 5. Striping: 2 inch (24 mm) wide contrasting color abrasive strips.
 - 6. Texture: Raised.

7. Pattern: Round.
8. Color: As indicated on drawings.
- B. Stair Risers: Full height and width of tread in one piece, matching treads in manufacturer, material and color.
 1. Thickness: 0.080 inch (2.0 mm).

2.03 RESILIENT BASE

- A. Resilient Base (Type RB-1 & 2): ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.
 1. Manufacturers:
 - a. Flexco Corporation.
 - b. Roppe Corporation.
 - c. Johnsonite, a Tarkett Company, (Basis-of-Design).
 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 3. Height: 4 inches (100 mm) or as otherwise indicated on the drawings.
 4. Thickness: 0.125 inch (3.2 mm).
 5. Finish: Satin.
 6. Length: Roll.
 7. Color: As indicated on drawings.

2.04 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Moldings, Transition and Edge Strips: Same material as flooring.
 1. Same manufacturer as flooring.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- B. Prohibit traffic until filler is fully cured.
- C. Clean substrate.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.

- C. Adhesive-Applied Installation:
 - 1. Spread only enough adhesive to permit installation of materials before initial set.
 - 2. Fit joints and butt seams tightly.
 - 3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 - 1. Resilient Strips: Attach to substrate using adhesive.

3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Install plank tile as indicated on drawings.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.06 INSTALLATION - STAIR COVERINGS

- A. Adhere over entire surface. Fit accurately and securely.

3.07 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.08 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

**SECTION 09 6700
FLUID-APPLIED FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fluid-applied (Resinous) flooring and base.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 07 9200 - Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.
- C. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- D. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- C. Samples: Submit two samples, 8 inch by 8 inch (203 by 203 mm) in size illustrating color and pattern for each floor material for each color specified.
- D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.
- F. Applicator's Qualification Statement.
- G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the work of this section.
 - 1. Minimum 5 years of documented experience.
 - 2. Approved by manufacturer.
- B. Pre-installation Conference: The general contractor shall arrange a meeting not less than 4 weeks prior to starting work.
 - 1. Attendance:
 - a. General Contractor

- b. Architect/Owner's Representative.
- c. Manufacturer/Installer's Representative.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.07 FIELD CONDITIONS

- A. Maintain minimum temperature in storage area of 55 degrees F (13 degrees C).
- B. Store materials in area of installation for minimum period of 24 hours prior to installation.
- C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fluid-Applied Flooring:
 - 1. Basis-of-Design: Stonhard, Inc. or approved equal.
Rep. Contact: Adam Deaton. Phone: (419)806-5119.
Email: adeaton@stonhard.com

2.02 FLUID-APPLIED FLOORING SYSTEMS

- A. Fluid-Applied Flooring (Type RF-1/FRF-1): Epoxy, with aggregate.
 - 1. System Thickness: 1/4 inch (6.4 mm) nominal, dry film thickness (DFT).
 - 2. Texture: Slip resistant (Level 2 texture).
 - 3. Color: Refer to Material Legend on drawings.
 - 4. Integral Cove Base: 4 inch (102 mm)
 - 5. Products: Subject to compliance with requirements, provide products by one of the following.
 - a. Stonhard; Stonclad GS with Stonekote GS4 (Basis-of-Design)

2.03 ACCESSORIES

- A. Base Caps: Zinc with projecting base of 1/8 inch (3 mm); mill finish color.
- B. Cant Strips: Molded of flooring resin material.
- C. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.
- D. Primer: Type recommended by fluid-applied flooring manufacturer.

2.04 SYSTEM COMPONENTS:

- A. Primer:
 - 1. Resin Epoxy
 - 2. Formulation: 100 percent solids
 - 3. Numbers of Coats: One
- B. Body Coat(s):
 - 1. Resin: Epoxy.
 - 2. Formulation Description: 100 percent solids.
 - 3. Application Method: Metal Trowel.
 - 4. Number of Coats: One.
- C. Topcoat:

1. Resin: Epoxy.
2. Formulation Description: 100% high solids.
3. Type: pigmented
4. Finish: Textured.
5. Number of Coats: One.

2.05 SYSTEM PHYSICAL PROPERTIES:

- A. Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
 1. Compressive Strength: 10,000 psi after 7 days per ASTM C 579.
 2. Tensile Strength: 1,750 psi per ASTM C 307.
 3. Flexural Modulus of Elasticity: 4,000 psi per ASTM C 580.
 4. Water Absorption: 0.2% per ASTM C 413.
 5. Coefficient of Thermal Expansion: 1.5×10^{-5} mm/ °C mm per ASTM C 531.
 6. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch (1.6-mm) permanent indentation per MIL-D-3134.
 7. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch (1.6 mm) per MIL-D-3134.
 8. Abrasion Resistance: 0.08 gm maximum weight loss per ASTM D 4060.
 9. Flammability: Self-extinguishing per ASTM D 635.
 10. Hardness: 85 to 90, Shore D per ASTM D 2240.
 11. Bond Strength: 400 psi, 100 percent concrete failure per ACI 503R.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).
 1. Test as Follows:
 - a. Alkalinity (pH): ASTM F710.
 - b. Internal Relative Humidity: ASTM F2170.
 - c. Moisture Vapor Emission: ASTM F1869.
 2. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.

3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- B. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
- C. Prepare concrete surfaces according to ICRI 310.2R, CSP 5.
- D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.
- E. Prepare sloped dish at floor drains.

- F. Vacuum clean substrate.
- G. Apply primer to surfaces required by flooring manufacturer.
- H. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated. Resinous based materials only. Cementitious or single component products not accepted.

3.03 INSTALLATION - ACCESSORIES

- A. Install cant strips at base of walls where flooring is to be extended up wall as base.
- B. Cove Base Radius: For solid radius integral cove base, resinous troweled mortar product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
- C. Install terminating cap strip at top of base; attach securely to wall substrate.

3.04 INSTALLATION - FLOORING

- A. Apply in accordance with manufacturer's instructions.
- B. Apply each coat to minimum thickness required by manufacturer.
- C. Finish to smooth level surface.
- D. Ensure flooring is installed with a positive slope to floor drain.
- E. Cove at vertical surfaces.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.

3.06 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Barricade area to protect flooring until fully cured.
- C. Protect resinous flooring materials from damage and wear during construction operation. Provide temporary cover. Comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

END OF SECTION

**SECTION 09 6813
TILE CARPETING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- C. Section 09 6500 - Resilient Flooring: for resilient wall base and accesories.

1.03 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).
- B. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Installer's Qualification Statement.
- G. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.06 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Tile Carpeting:
 - 1. Shaw Contract, (Basis-of-Design) or approved equal.

2.02 MATERIALS

- A. Tile Carpeting, Type CPT-1: Tufted, manufactured in one color dye lot.
 - 1. Product: Refer to drawings for carpet style, size and color.
- B. Tyle Carpeting: Type MAT-1, manufactured in one color dye lot.
 - 1. Product: Refer to drawings for carpet style, size and color.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Edge Strips: Vinyl, color as selected by Architect.
- C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Vacuum clean substrate.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Locate change of color or pattern between rooms under door centerline.
- G. Fully adhere carpet tile to substrate.
- H. Trim carpet tile neatly at walls and around interruptions.
- I. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

- B. Clean and vacuum carpet surfaces.

END OF SECTION

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**SECTION 09 9113
EXTERIOR PAINTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
 - 7. Glass.
 - 8. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 05 5000 - Metal Fabrications: Shop-primed items.
- C. Section 09 9123 - Interior Painting.

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.
- B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.
- C. ASTM D4259 - Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application; 2024.
- D. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- F. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- G. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 2. MPI product number (e.g. MPI #47).
 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 4. Manufacturer's installation instructions.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
- D. Samples: Submit two paper chip samples, 8.5 x 11 inch (216 x 279 mm) in size illustrating range of colors and textures available for each surface finishing product scheduled.
- E. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- F. Manufacturer's Instructions: Indicate special surface preparation procedures.
- G. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
 2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
 3. Label each container with color in addition to the manufacturer's label.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

- B. Paints:
 - 1. Base Manufacturer: Subject to compliance with requirements, provide products by the following:
 - 2. Benjamin Moore & Co.
 - 3. Pittsburgh Paints.
 - 4. Sherwin-Williams Company; Basis-of-Design.
- C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: As indicated on drawings.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including primed metal.
 - 1. Two top coats and one coat primer.
 - 2. Primer:
 - a. Sherwin-Williams Pro Industrial Acrylic, Pro-Cryl Universal Primer, Eg-Shel
 - 3. Top Coat(s): Exterior Light Industrial Coating, Water Based; MPI #161, 163, or 164.
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial DTM Acrylic, Semi-Gloss. (MPI #163)

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 - 1. Water Based Primer for Galvanized Metal; MPI #134.
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer. (MPI #134)
 - 2. Rust-Inhibitive Water Based Primer; MPI #107.
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer. (MPI #107)

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- H. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.
- I. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

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**SECTION 09 9123
INTERIOR PAINTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
 - 6. Floors, unless specifically indicated.
 - 7. Ceramic and other tiles.
 - 8. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
 - 9. Glass.
 - 10. Acoustical materials, unless specifically indicated.
 - 11. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 05 5000 - Metal Fabrications: Shop-primed items.
- C. Section 09 9113 - Exterior Painting.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.
- C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.
- D. ASTM D4259 - Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application; 2024.
- E. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- F. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

- G. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- H. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. MPI product number (e.g., MPI #47).
 - 3. Cross-reference to specified paint system products to be used in project; include description of each system.
- C. Samples: Submit two paper chip samples, 8.5 x 11 inch (216 x 279 mm) in size illustrating range of colors and textures available for each surface finishing product scheduled.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.
- E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gal (4 L) of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F (3 degrees C) above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 fc (860 lux) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Base Manufacturer: Subject to compliance with requirements, provide products by the following.
 - 2. Benjamin Moore & Co.
 - 3. Pittsburgh Paints.
 - 4. Sherwin-Williams Company: Basis-of-Design.
- C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: As indicated on drawings.
 - 1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
 - 1. Medium duty applications include doors, door frames, railings, handrails, and guardrails.
 - 2. Two top coats and one coat primer.
 - 3. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, 141, or 142.
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
 - 4. Top Coat Sheen:

- a. Satin: MPI gloss level 4; use this sheen at all locations.
5. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-WC - Medium Duty Vertical and Overhead: Including gypsum board.
 1. Two top coats and one coat primer.
 2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.
 - a. Products:
 - 1) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eg-Shel.
 3. Top Coat Sheen:
 - a. Eggshell: MPI gloss level 3; use this sheen at all locations.
 4. Primer: As recommended by top coat manufacturer for specific substrate.
- C. Paint I-OP-HD-WC - Heavy Duty Vertical and Overhead: Including gypsum board (where epoxy paint is indicated on drawings)
 1. Two top coats and one coat primer.
 2. Top Coat(s): Interior Light Industrial Coating, Water Based; MPI #151, 153, or 154.
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #151)
 3. Top Coat Sheen:
 - a. Eggshell: MPI gloss level 3; use this sheen at all locations.
 4. Primer: As recommended by top coat manufacturer for specific substrate.
- D. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
 1. Shop primer by others.
 2. One top coat.
 3. Top Coat: Latex Dry Fall.
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial Waterborne Acrylic Dryfall, Eg-Shel. (MPI #155, 226)
 4. Top Coat Sheen:
 - a. Eggshell: MPI gloss level 3; use this sheen at all locations.
 5. Primer: As recommended by top coat manufacturer for specific substrate.
- E. Paint I-OP-FL - Concrete Floors to be Painted.
 1. Two top coats and one coat primer.
 2. Primer: Same as top coat.
 3. Top Coat(s): Epoxy Floor Paint Coating.
 - a. Products:
 - 1) Sherwin-Williams, Water base epoxy floor coating, Armoseal 8100.
 4. Top Coat Sheen:
 - a. Satin: MPI gloss level 4; use this sheen at all locations.
- F. Paint WI-OP-3A - Wood, Opaque, Alkyd, 3 Coat:
 1. Primer: One coat alkyd primer sealer.
 2. Top Coats: Two coats of alkyd enamel - Satin
 - a. Products: Sherwin Williams, Pro Classic Interior Alkyd

2.04 PRIMERS

- A. Primers: Refer to Paint Systems for primer information unless other primer is required or recommended by manufacturer of top coats.
 1. Interior Institutional Low Odor/VOC Primer Sealer; MPI #149.
 - a. Products:

- 1) Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer.
2. Interior Rust-Inhibitive Water Based Primer; MPI #107.
 - a. Products:
 - 1) Sherwin-Williams Pro-Cryl Universal Primer. (MPI #107)
3. Interior Water Based Primer for Galvanized Metal; MPI #134 or #134 X-Green.
 - a. Products:
 - 1) Sherwin-Williams Pro-Cryl Universal Primer. (MPI #134)
4. Interior Alkyd Enamel Undercoat; MPI #46.
5. Latex Primer for Interior Wood; MPI #39.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 3. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Galvanized Surfaces:
- H. Ferrous Metal:
 1. Solvent clean according to SSPC-SP 1.
 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

- I. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- E. Sand metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

**SECTION 10 2113.17
PHENOLIC TOILET COMPARTMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Phenolic toilet compartments.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 REFERENCE STANDARDS

- A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- D. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Phenolic Toilet Compartments:
 - 1. All American Metal Corp - AAMCO.
 - 2. ASI Accurate Partitions.
 - 3. Hadrian.

2.02 PHENOLIC TOILET COMPARTMENTS

- A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted headrail-braced.
 - 1. Color: Single color as selected from manufactures standard colors.
- B. Doors:
 - 1. Thickness: 3/4 inch (19 mm).
 - 2. Width: 24 inch (610 mm).
 - 3. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
 - 4. Height: 58 inch (1473 mm).
- C. Panels:
 - 1. Thickness: 1/2 inch (13 mm).
 - 2. Height: 58 inch (1473 mm).
 - 3. Depth: As indicated on drawings.
- D. Pilasters:

1. Thickness: 3/4 inch (19 mm).
2. Width: As required to fit space; minimum 3 inch (76 mm).

2.03 ACCESSORIES

- A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch (76 mm) high, concealing floor fastenings.
- B. Head Rails: Hollow anodized aluminum, 1 inch by 1-1/2 inch (25 mm by 38 mm) size, with anti-grip profile and cast socket wall brackets.
- C. Wall and Pilaster Brackets: Polished stainless steel; manufacturer's standard type for conditions indicated on drawings.
- D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
- E. Hardware: Polished stainless steel:
 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
 2. Door Latch: Slide type with exterior emergency access feature.
 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
 4. Coat hook with rubber bumper; one per compartment, mounted on door.
 5. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.03 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch (6 mm).
- B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

END OF SECTION

SECTION 10 2800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Commercial shower and bath accessories.
- C. Utility room accessories.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 22 4000 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.
- C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- D. ASTM C1036 - Standard Specification for Flat Glass; 2025.
- E. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.
- F. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2021.
- G. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 2. Bradley Corporation: www.bradleycorp.com/#sle.
 - 3. Bobrick Washroom Equipment, Inc. (Basis-of-Design).

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Keys: Provide 3 keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666/A666M, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. Mirrors (T02): Stainless steel framed, 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.
 - 1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
 - 2. Size: As indicated on drawings.
 - 3. Frame: 0.05 inch (1.3 mm) angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
 - 4. Products:
 - a. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc., B-290, (Basis-of-Design).
- B. Grab Bars (T01, T04): Stainless steel, smooth surface.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
 - b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, exposed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
 - c. Finish: Satin.
 - d. Length and Configuration: As indicated on drawings.
 - e. Products:
 - 1) American Specialties, Inc.
 - 2) Bobrick Washroom Equipment, Inc., B-6806, (Basis-of-Design).
- C. Sanitary Napkin Disposal Unit (T06): Stainless steel, recessed, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
 - 1. Products:
 - a. Bobrick Washroom Equipment, Inc., B-4353, (Basis-of-Design).
- D. Sanitary Napkin Disposal Unit (T07): Stainless steel, back-to-back partition mounted with adjustable flanges, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
 - 1. Products:
 - a. Bobrick Washroom Equipment, Inc., B-4354, (Basis-of-Design).

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

- A. Shower Curtain Rod (T03): Stainless steel tube, 1 inch (25 mm) outside diameter, 0.04 inch (1.0 mm) wall thickness, satin-finished, with 2.5 inch (63.5 mm) square minimum 0.04 inch (1.0 mm) thick satin-finished stainless steel flanges, for installation with exposed fasteners.
 - 1. Products:
 - a. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc., B-6107, (Basis-of-Design).
- B. Shower Curtain (T03):
 - 1. Material: Opaque vinyl, 0.008 inch (0.2 mm) thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
 - 2. Size: 72 by 72 inches (1830 by 1830 mm), hemmed edges.
 - 3. Grommets: Stainless steel; pierced through top hem on 6 inch (150 mm) centers.
 - 4. Color: White.
 - 5. Shower Curtain Hooks: Chrome-plated or stainless steel spring wire designed for snap closure.
 - 6. Products:
 - a. Bobrick Washroom Equipment, Inc., 204-3 and 204-1, (Basis-of-Design).
 - b. American Specialties, Inc.
- C. Folding Shower Seat (T05): Wall-mounted surface; welded tubular seat frame, structural support members, swing-down legs, hinges, and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand seat.
 - 1. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of color as selected.
 - 2. Size: ADA Standards compliant.
 - 3. Products:
 - a. Bobrick Washroom Equipment, Inc., B-5181, (Basis-of-Design).
 - b. American Specialties, Inc.
- D. Clothes Hook (T11): Heavy-duty stainless steel, single-prong, bracket and backplate for concealed attachment, satin finish.
 - 1. Products:
 - a. Bobrick Washroom Equipment, Inc., B-211, (Basis-of-Design).
 - b. American Specialties, Inc.
 - c. Location: Refer to the Interior Elevation on the Drawings.
- E. Coat Hook (T12): Polished Aluminum double hook.
 - 1. Products:
 - a. Peter Pepper Mfr. Model: #2073 (Basis-of-Design), or approved equal.
 - 2. Location: Coat Alcove C108.3 and Office Doors. Refer to Door and Frame Schedule on the Drawings.

2.06 UTILITY ROOM ACCESSORIES

- A. Combination Utility Shelf/Mop and Broom Holder (T10): 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 1/2 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.
 - 1. Hooks: Three, 0.06 inch (1.6 mm) stainless steel rag hooks at shelf front.
 - 2. Mop/broom holders: Four spring-loaded rubber cam holders at shelf front.
 - 3. Length: 36 inches (900 mm).
 - 4. Products:
 - a. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc., B-224, (Basis-of-Design).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.

3.02 PREPARATION

- A. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Mounting Heights: As required by accessibility regulations, unless otherwise indicated or as indicated on the drawings.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

**SECTION 10 4400
FIRE PROTECTION SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Accessories.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide; Current Edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.
- C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, and anchorage details.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Activar Construction Products Group, Inc. - JL Industries.
 - 2. Kidde, a unit of United Technologies Corp.
 - 3. Nystrom, Inc.

2.02 FIRE EXTINGUISHERS (PROVIDED BY OWNER)

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Class: A:B:C type.
 - 2. Size: 10 pound (4.54 kg).
 - 3. Finish: Baked polyester powder coat, color as selected.
 - 4. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

2.03 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Place extinguishers in cabinets and on wall brackets.

END OF SECTION

**SECTION 10 5113
METAL LOCKERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal lockers.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2024b.
- C. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2024.
- D. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes, and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan.
- D. Manufacturer's Installation Instructions: Indicate component installation assembly.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Lockers:
 - 1. Hadrian
 - 2. Lyon Workspace Products
 - 3. Republic Storage Systems Co

2.02 LOCKER APPLICATIONS

- A. Standard: Metal lockers, free-standing with matching closed base.(L-1)
 - 1. Width: 15 inches (381 mm).
 - 2. Depth: 18 inches (457 mm).
 - 3. Height: 72 inches (1830 mm).
 - 4. Configuration: Single tier.
 - 5. Fittings: Size and configuration as indicated on drawings.
 - 6. Ventilation: Louvers at top and bottom of door panel.
 - 7. Locking: Padlock hasps, for padlocks provided by Owner.
 - 8. Provide sloped top.
 - 9. Color: To be selected from manufacturer's full range by Architect.

2.03 METAL LOCKERS

- A. Accessibility: One (1) unit in each cluster to designed as 'accessible' to comply with ICC A117.1 and ADA Standards.
- B. Locker Case Construction:
 - 1. Standard-Duty, Knocked Down Construction: Made of formed sheet steel; metal edges finished smooth without burrs; baked enamel or powder coat finished inside and out.
 - a. Locker Body Components: Formed and flanged from steel sheet of the following type and minimum thicknesses:
 - 1) Unperforated Steel Sheet: Commercial Steel (CS), Type B, supplied for exposed applications and complying with ASTM A1008/A1008M and the following:
 - 2) Body and Shelves: 24 gauge, 0.0239 inch (0.61 mm).
 - 3) Backs: 24 gauge, 0.0239 inch (0.61 mm).
 - 4) Base: 18 gauge, 0.0478 inch (1.21 mm).
 - (a) Height: 6" inch (152 mm).
 - b. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
 - 1) Door Frame: 16 gauge, 0.0598 inch (1.52 mm), minimum.
- C. Doors: Channel edge; welded construction, manufacturer's standard stiffeners, grind and finish edges smooth.
 - 1. Door Thickness: 16 gauge, 0.0598 inch (1.52 mm), minimum.
 - 2. Form recess for operating handle and locking device.
- D. Latches and Door Handles: Manufacturer's standard.
 - 1. Latching Components: 300 Series Stainless Steel (ASTM A240/A240M).
 - 2. Latching: Manufacturer's standard for locking arrangement selected.
 - a. Three-Point Lift Handle Gravity Latch: Pocket-mounted, provide for doors 18 inches (457 mm) or taller.
 - 1) Handle Pocket, Recess: Stainless steel flush-mounted cup recessed into face of door.
 - 2) Handle: Steel finger lift mechanism with exposed portion encased in molded plastic trigger.
 - (a) Padlock Eye: Integral with lift trigger, sized for use with 9/32 inch (7.1 mm) diameter padlock shackles.
- E. Hinges: Heavy-duty, 7-knuckle type; two for doors under 42 inches (1050 mm) high; three for doors over 42 inches (1 050 mm) high.
- F. Sloped Top: 20 gauge, 0.0359 inch (0.91 mm), with closed ends.
- G. Trim: 20 gauge, 0.0359 inch (0.91 mm).
- H. Coat Hooks: Stainless steel or zinc-plated steel.
- I. Locks: Locker manufacturer's standard type indicated in Applications article above.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared bases are in correct position and configuration.
- B. Verify bases and embedded anchors are properly sized.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Place and secure on prepared base.

- C. Install lockers plumb and square.
- D. Install fittings if not factory installed.
- E. Replace components that do not operate smoothly.

3.03 CLEANING

- A. Clean locker interiors and exterior surfaces.

END OF SECTION

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**SECTION 11 5313
LABORATORY FUME HOODS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Standard laboratory fume hoods.
- B. Exhaust blowers.
- C. Work surfaces.
- D. Service fittings and outlets.
- E. Airflow indicators and alarms.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 06 1000 - Rough Carpentry: Blocking and nailers for anchoring fume hoods.
- C. Section 09 2216 - Non-Structural Metal Framing: Reinforcements in metal-framed partitions for anchoring fume hoods.
- D. Section 12 3553.13 - Metal Laboratory Casework: Additional requirements for base cabinets for fume hoods.
- E. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC: Field quality-control testing of fume hoods.

1.03 REFERENCE STANDARDS

- A. ASHRAE Std 110 - Methods of Testing Performance of Laboratory Fume Hoods; 2016, with Errata.
- B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2024b.
- C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2024.
- E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.
- F. ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials; 2017, with Editorial Revision (2019).
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- H. SEFA 1 - Laboratory Fume Hoods; 2010.
- I. SEFA 2 - Installations; 2010.
- J. UL 1805 - Standard for Safety Laboratory Fume Hoods and Cabinets; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate installation of fume hoods with laboratory casework and other laboratory equipment.

- B. Preinstallation Meeting: Conduct preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide fume hood exterior and interior dimensions and construction, utility and service requirements and locations.
- C. Shop Drawings: Indicate locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, clearances required, locations and types of service fittings.
- D. Samples: Submit two samples of exterior, interior, and work top finish surfaces, illustrating color and finish.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. Provide documentation of successful Factory Acceptance Testing.
- F. Test Reports: Indicate that each type of fume hood has been factory-tested and meets specified ASHRAE Std 110 (AM) requirements.
- G. Manufacturer's Installation Instructions: Indicate special installation requirements.
- H. Operation Data: Include description of equipment operation and required adjusting and testing.
- I. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and spare part sources.
- J. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- K. Project Record Documents: Record actual locations of concealed utility connections.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum five years of documented experience.
- C. Preconstruction Testing: Factory-test each type of hood as per referenced standard.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.08 FIELD CONDITIONS

- A. Ambient Conditions: Maintain temperature and relative humidity at occupancy levels during and after installation of fume hoods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Laboratory Fume Hoods:
 - 1. Hamilton Laboratory Soultions; SafeAir II, Basis-of-Design, or approved equal.
 - 2. Rep. Contact: Neis Collective
Mark Barrett, Phone: (614) 515-1868

Email: mark.barrett@neis.com

- B. Provide laboratory fume hoods, fume hood casework, work surfaces, and other equipment from single manufacturer.

2.02 CONSTANT AIR VOLUME (CAV) FUME HOODS

- A. Bypass Fume Hoods:
 - 1. Include a built-in compensating bypass arrangement to maintain constant exhaust volume regardless of sash position.
- B. Auxiliary Air System:
 - 1. Include an-air outlet for connection to an external supply air source equal to 70 percent of the exhausted air volume. Introduce air directly above and immediately in front of hood face.

2.03 PERFORMANCE REQUIREMENTS

- A. Fume hoods complying with the following when tested in accordance with ASHRAE Std 110:
 - 1. As-Manufactured (AM) Rating: AM 0.01 (0.01 ppm).
 - 2. As-Installed (AI) Rating: AI 0.10 (0.10 ppm).
 - 3. Average Face Velocity: 100 FPM (0.51 m/s) plus or minus 10 percent with sashes fully open.
 - 4. Face-Velocity Variation: Not more than 10 percent of average face velocity across the face opening with sash(es) fully open.
 - 5. Release Rate: 4.0 L/min.
 - 6. Static-Pressure Loss: Not more than 1/2-inch w.g. (124 Pa) at 100 FPM (0.51 m/s) face velocity with sash fully open when measured at four locations 90 degrees apart around the exhaust duct and at least three duct diameters downstream from duct collar.

2.04 FUME HOODS

- A. General Requirements:
 - 1. Comply with SEFA 1.
 - a. Provide fume hoods UL listed and labeled for compliance with UL 1805.
 - 2. Pre-pipe fume hoods for service fittings.
 - 3. Pre-wire fume hoods for light fixtures and receptacles.
 - a. Terminate all wiring in a junction box on top of hood.
- B. Types: FH-01, FH-02, FH-03, FH-04 , Fume Hood:
 - 1. Ventilation: Constant Air Volume (CAV).
 - 2. Configuration: Sitting-height; bench mounted.
 - 3. Nominal Interior Height: 60 inches (1524 mm).
 - 4. Depth: 31-1/4 inches (794 mm)
 - 5. Sash Type: Vertical rising.
 - a. Configuration: As indicated on drawings.
 - b. Leak-free enclosure box, manufacturer's standard construction, for vertical rising sash.
 - c. Glazing: Laminated safety glass.
 - d. Sash Guides: Corrosion-resistant polyvinyl chloride (PVC) track.
 - e. Vertical Sash mechanism: Designed to prevent sash drop in case of mechanism failure.
 - 1) Cable: Minimum 3/32 inch (2 mm) thick stainless steel of construction standard with the manufacturer.
 - f. Vertical Sash Pull: Type 316 stainless steel, with No.4 finish.
 - 6. Top Front Panel: Standard integral grille stamped into panel of same materials as fume hood exterior.
 - 7. Exterior: Sheet steel.
 - 8. Interior Lining: Polypropylene.
 - 9. Service Fittings and Fixtures:
 - a. Refer to drawings for additional information.

- b. Cup Sink : Drop-in Polyolefin, complete with removable stainer and waste fitting.
 - 1) Shape: Round.
 - 2) Size: 5 inch (127mm) diameter.
 - c. Specialty Gas Fitting Assembly: Needle valve service for gases. Refer to drawings for type of gases. .
 - d. Water Outlet Fitting Assembly: Fornt- loaded water faucet, single service valve with vacuum breaker.
- 10. Access Panels: Provide removable panels on both sides hood exterior and interior lining panels.
- 11. Work Surface:
 - a. Work Top for Fume Hoods Other Than Floor-mounted Type: Epoxy resin.
 - 1) Edge: Raised rim with beveled edges and corners.
 - 2) Full width drain trough at rear.
- C. Light Fixtures: UL labeled, vaporproof, LED light fixtures. Number and length of fixtures as necessary for fume hood width. Mounted above sealed safety glass panel. White baked-enamel finish on fixture interior.

2.05 FABRICATION

- A. General: Assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations, or as necessary to permit movement through a 35 inches by 79 inches (889 mm by 2007 mm) clear door opening.
- B. Ends: Fabricated with double-wall end panels. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.
- C. Lining Assembly: Unless otherwise indicated, assembled with stainless-steel fasteners or epoxy adhesive, concealed where possible. Joints sealed by filling with chemical-resistant sealant during assembly.
 - 1. Punched fume hood lining side panels for service fittings and remote controls. Removable plug buttons for holes not used for indicated fittings.
- D. Rear Baffle: Same material as fume hood lining, unless otherwise indicated, at rear of hood with openings at top and bottom, with corrosion-resistant fasteners. Fabricated for removal to facilitate cleaning behind baffle.
- E. Exhaust Plenum: Full width of fume hood, sized and configured to provide uniform airflow, of same material as hood lining, and with duct stub for exhaust connection.
 - 1. Duct-Stub Material: Epoxy-coated steel, unless otherwise indicated.
- F. Airfoil: At bottom of fume hood face opening, with 1 inch (25.4 mm) gap between bottom of airfoil and work top. Sash to close on top of airfoil. Designed to direct airflow across work.
 - 1. Fabricated from 14 gauge, 0.0781 inch (1.98 mm) stainless steel with No.4 finish.
- G. Filler Strips: As needed to close spaces between fume hoods and/or fume hood base cabinets and adjacent building construction. Fabricated from same material and with same finish as fume hoods or fume hood base cabinets, as applicable. Flange, notch, and reinforce filler strips. Fabricate to form well-fitting closures, free from oil-canning.
- H. Ceiling Extensions: Filler panels matching fume hood exterior to enclose space above fume hoods at front and sides of fume hoods, and extending from tops of fume hoods to approximately 4 inches (102 mm) above ceiling. Flange, notch, and reinforce ceiling extensions as required for rigidity. Fabricate to form well-fitting closures, free from oil-canning.
- I. Finished Back Panels: Where rear surfaces of fume hoods are exposed to view, provide finished back panels matching rest of fume hood enclosure.

- J. Comply with requirements of other sections for factory installation of water and laboratory gas service fittings, piping, electrical devices, and wiring. Securely anchor fittings, piping, and conduit to fume hoods, unless otherwise indicated.

2.06 MATERIALS

- A. Steel Sheet: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A1008/A1008M; matte finish; suitable for exposed applications.
- B. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666/A666M, Type 304, stretcher-leveled standard of flatness.
- C. Epoxy: Factory molded, modified epoxy-resin formulation with smooth, nonspecular finish.
 - 1. Physical Properties:
 - a. Flexural Strength: Not less than 10,000 pounds per square inch (70 MPa).
 - b. Modulus of Elasticity: Not less than 2,000,000 pounds per square inch (1,400 MPa).
 - c. Hardness (Rockwell M): Not less than 100.
 - d. Water Absorption (24 Hours): Not more than 0.02 percent.
 - e. Heat Distortion Point: Not less than 260 degrees F (127 degrees C).
 - f. Flame-Spread Index: 25 or less according to ASTM E84.
 - 2. Chemical Resistance: As follows when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
 - a. No Effect:
 - 3. Color: Black.
- D. Polypropylene: Unreinforced polypropylene complying with ASTM D4101, Group 01, Class 1, Grade 2.
- E. Laminated Safety Glass: ASTM C1172.
- F. 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.
- G. Fasteners: Stainless-steel, where exposed to fumes.

2.07 ACCESSORIES

- A. Airflow Monitors/Indicators and Alarms: Provide each fume hood with a airflow monitor/indicator complete with an audible and visual alarm that activates when airflow sensor reading is outside of preset range.
 - 1. Source: Fume hood manufacturer.
 - 2. Airflow Monitor/Indicator Functionality:
 - a. Type: A sensor module that monitors fume hood face velocity, and a display module that presents data as digital readout.
 - 1) Input power: 9 to 30 V AC/DC. Include power supply module or functionality.
 - 2) Display Range: 0 to 1,000 FPM (0 to 5.08 m/s).
 - 3) Alarm Condition Range: 50 to 250 FPM (0.25 to 1.27 m/s).
 - 4) Mounting: Flush.
 - 5) Readings: Remote sensor inserted in airflow stream.
 - 6) Accuracy: Maximum plus or minus 5 percent of set point.
 - 7) Visual Status Display: Green, yellow, and red LEDs.
 - 8) Airflow Display: Digital display of face velocity reading.
 - 9) Operating temperature: 55 to 86 degrees F (13 to 30 degrees C).
 - 3. Airflow Alarm functionality: Audible (85 dB @ 4 inch (102 mm) distance), and visual alarm that activates when airflow sensor reading is outside of preset range.
 - a. Reset and test mode.
 - b. Programmable Switch: Designed to silence audible alarm and automatically reset when airflow returns to within preset range. Warning light to stay on when alarm is silenced.
 - c. Programmable relay output.

- d. Capability for integration with BAS (Building Automation System) via BACnet.
 - e. Alarm included as an integral feature of the airflow monitor/indicator.
- B. Fume Hood Controller: Airflow Indicator/monitor with built-in electronics to control a dedicated exhaust fan and/or exhaust valve.
 - 1. Fume hood manufacturer's standard controller.
- C. Sash Alarms: Audible and visual alarm that activates when sash is opened beyond preset position.
 - 1. Programmable silence and test switches.
- D. Sash Stops: Spring-loaded stops to limit hood opening to 18 inches (457 mm) height (28.5 inches sash opening for setup). Manually releasable to open sash fully, and to reset automatically when sash is lowered below set level.
- E. Variable Transformer: On/off control switch and a transformer with single voltage input and variable voltage output, of the following configuration:
 - 1. Single-Phase:
 - a. Input: 120 VAC; Output - 0 to 140 VAC.
- F. Electrical Outlets: Three wire grounding type receptacles rated at 120 Volts GFCI, at 20 amperes.

2.08 EXHAUST BLOWERS

- A. Dedicated exhaust blower at each fume hood indicated to be individually exhausted, of airflow capacity recommended by fume hood manufacturer.
 - 1. Type: Direct drive.
 - 2. Materials: Epoxy-coated steel.
 - 3. Controls: On/Off using Fan switch located on fume hood post.
 - 4. Model selection coordinated with building electrical services.
 - 5. Model selection coordinated with expected static pressure losses in exhaust ductwork.

2.09 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Factory testing of each type of fume hood.
- C. Non-Complying Work: See Section 01 4000.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Locate concealed framing, blocking, and reinforcements that support fume hoods by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- B. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install fume hoods according to manufacturer's written instructions. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework. Securely attach access panels but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
- B. Large Components: Ensure that large components can be moved into final position without damage to other construction.

- C. Comply with indicated requirements for installing water and laboratory gas service fittings, and electrical and telecommunications devices.
 - 1. Install fittings in accordance with shop drawings, installation requirements in SEFA 2, and manufacturer's written instructions. Set bases and flanges of sink and work top-mounted fittings in sealant recommended by manufacturer of sink or work-top material. Securely anchor fittings to fume hoods.
- D. Exhaust Blowers:
 - 1. Turn over to appropriate trade contractor(s) for installation.

3.03 FIELD QUALITY CONTROL

- A. Field test fume hoods as specified below.
 - 1. General: Test fume hoods as installed to assess airflow velocity. Perform tests with static mode (set sash position) conditions. Conduct testing as outlined below for 100% of the hoods provided in the Project.
 - 2. Preparation:
 - a. Inspect each fume hood to confirm its installation complies with drawings and specifications.
 - b. Do not proceed with fume hood testing until an acceptable TAB report has been received.
 - c. Verify that proper temperature and pressurization of the lab space can be maintained, with door(s) to the space in closed and open positions.
 - d. Adjust non-complying physical and control systems until conditions favorable to testing fume hoods are present.
 - 3. Operating Conditions Tests:
 - a. Conduct face velocity tests to confirm that target velocities are being achieved within acceptable tolerances.
 - b. Conduct airflow indicator/monitor tests to confirm acceptable variation from corresponding measured value. Calibrate and adjust device to function within specified accuracy parameters.
 - c. Conduct exhaust flow and static pressure tests of the HVAC system and its controls to confirm flow volume and static pressures are within acceptable tolerances.
- B. Reporting Requirements: Comply with Section 5 of NEBB Fume Hood Testing (FHT) Standard, current edition. Organize and include, at a minimum, the following information:
 - 1. Report title.
 - 2. Report certification.
 - 3. Table of contents.
 - 4. Report summary/ remarks.
 - 5. Appropriate forms.
 - 6. Instrument calibration.
 - 7. List of abbreviations used.
 - 8. A room layout drawing for each tested item. Identify: walls; doors; fume hood(s); other present environmental enclosures (e.g. biological safety cabinet(s), laminar flow hood(s), canopy hood(s), etc.); location and airflow pattern of all air supply, return, and exhaust grilles, registers and diffusers.

3.04 ADJUSTING

- A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand only. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.

3.05 CLEANING

- A. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

3.06 DEMONSTRATION

- A. Demonstrate proper operation of fume hoods and their accessories to Owner's designated representative.

3.07 FUME HOOD SCHEDULE

- A. See drawings for Fume Hood Schedule.

END OF SECTION

**SECTION 12 2400
WINDOW SHADES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior manual roller shades.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

- A. ASTM E2180 - Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) in Polymeric or Hydrophobic Materials; 2018.
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.
- C. WCMA A100.1 - Standard for Safety of Window Covering Products; 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing:
 - 1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
 - 2. Do not install shades until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
- D. Verification Samples: Minimum size 6 inches (150 mm) square, representing actual materials, color and pattern.
- E. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of this type with minimum 5 years of documented experience with shading systems of similar size and type.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

- B. Handle and store shades in accordance with manufacturer's recommendations.

1.08 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
 - 1. Shade Hardware: One year.
 - 2. Fabric: One year.
 - 3. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 ROLLER SHADES

- A. General:
 - 1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
 - 2. Provide shade system that operates smoothly when shades are raised or lowered.
- B. Roller Shades - Basis of Design: MechoShade Systems LLC; Mecho/5 System , or approved equal.
 - 1. Description: Single roller, manually operated fabric window shades.
 - a. Drop Position: Regular roll.
 - b. Mounting: Window jamb mounted.
 - c. Size: As indicated on drawings.
 - d. Fabric: As indicated under Shade Fabric article.
 - 2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
 - a. Material: Steel, 1/8 inch (3 mm) thick.
 - 3. Roller Tubes:
 - a. Material: Extruded aluminum.
 - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
 - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
 - d. Capable of being removed and reinstalled without affecting roller shade limit adjustments.
 - 4. Hembars: Designed to maintain bottom of shade straight and flat.
 - a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
 - b. Room-Darkening Shades: Provide a slot in bottom bar with wool-pile light seal.
 - 5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
 - a. Provide a permanently lubricated brake assembly mounted on an oil-impregnated hub with wrapped spring clutch.
 - b. Brake must withstand minimum pull force of 50 lb (22.7 kg) in the stopped position.
 - c. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.
 - 6. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 lb (43 kg) minimum breaking strength. Provide upper and lower limit stops.
 - a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.

7. Accessories:
 - a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; clear anodized finish.
 - 1) Profile: Square.

2.02 SHADE FABRIC

- A. Fabric for Room-Darkening Shades: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
 1. Manufacturers:
 - a. MechoShade Systems LLC, or approved equal.
 2. Material: Thermoplastic olefin (TPO).
 - a. Product: EcoVail, 1350 Series (5% Open) Color: 1366 Eggshell (Basis-of-Design)

2.03 ROLLER SHADE FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
 1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch (13 mm) space between bottom bar and window stool.
 2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
- C. Dimensional Tolerances: As recommended in writing by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
- C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

3.05 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

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**SECTION 12 3553.13
METAL LABORATORY CASEWORK**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Standard and custom metal cabinets and cabinet hardware.
- B. Workbenches (Tables).
- C. Acid storage cabinets.
- D. Solvent storage cabinets.
- E. Epoxy Resin Countertops.
- F. Laboratory sinks.
- G. Pegboards.

1.02 RELATED REQUIREMENTS

- A.
- B. Section 06 1000 - Rough Carpentry: Blocking and nailers for anchoring casework.
- C. Section 07 9200 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.
- D. Section 09 2216 - Non-Structural Metal Framing: Reinforcements in metal-framed partitions for anchoring casework.
- E. Section 09 6500 - Resilient Flooring: Resilient wall base.
- F. Section 09 6623 - Resinous Epoxy Flooring: Integral cove base.
- G. Section 11 5313 - Fume Hoods
- H. Section 12 3553.23 - Solid Plastic (Phenolic Resin) Laboratory Casework.
- I. Section 22 4200 - Plumbing Fixtures: Non-laboratory sinks service fittings, and emergency equipment.
- J. Section 26 0533.23 - Surface Raceways for Electrical Systems: Surface raceway systems.

1.03 REFERENCE STANDARDS

- A. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2024.
- E. ASTM C1036 - Standard Specification for Flat Glass; 2025.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.
- G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

- H. ASTM D522/D522M - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings; 2017 (Reapproved 2021).
- I. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- K. BHMA A156.9 - Cabinet Hardware; 2020.
- L. NFPA 30 - Flammable and Combustible Liquids Code; 2024, with Errata (2025).
- M. SEFA 1 - Laboratory Fume Hoods; 2010.
- N. SEFA 2 - Installations; 2010.
- O. SEFA 3 - Laboratory Work Surfaces; 2020.
- P. SEFA 7 - Laboratory Fixtures; 2021.
- Q. SEFA 8M - Laboratory Grade Metal Casework; 2020.
- R. SEFA 11 - Liquid Chemical Storage Cabinets; 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate installation of casework with related items.
 - 1. Service Fixtures: Coordinate location and characteristics of service connections.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors and reinforcements placement dimensions and tolerances, clearances required, and utility locations, if any. Include coordinated information for laboratory equipment specified in another section and/or furnished by Owner.
- C. Samples For Color Selection: Color charts for each different finish material.
- D. Test Reports: Independent laboratory reports showing compliance with chemical and physical resistance requirements for casework finish.
- E. Maintenance Data: Manufacturer's recommendations for care and cleaning.
- F. Finish touch-up kit for each type and color of materials provided.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of documented experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Laboratory Casework:

1. Hamilton Laboratory Solutions; (Basis-of-Design), or approved equal.
 2. Substitutions: See Section 01 2500 - Substitution Procedures. Submit evidence that the proposed substitution complies with the specified requirements.
- B. Countertops:
1. Durcon (Epoxy resin); (Basis-of-Design), or approved equal.
 2. Substitutions: See Section 01 2500 - Substitution Procedures. Submit evidence that the proposed substitution complies with the specified requirements.
- C. Sinks and Cup Sinks:
1. Durcon (Epoxy resin, Polyolefin); (Basis-of-Design).
 2. Substitutions: See Section 01 2500 - Substitution Procedures. Submit evidence that the proposed substitution complies with the specified requirements.
- D. Obtain casework from single source and manufacturer, unless otherwise indicated.

2.02 METAL LABORATORY CASEWORK

- A. Casework: Die-formed metal sheet; each unit self-contained and not dependent on adjacent units or building structure for rigidity; factory-fabricated, factory-assembled, and factory-finished.
1. Style: Inset - square edge.
 2. Primary Cabinet Material: Cold-rolled steel.
 3. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions.
 - a. Base Cabinets: 22 inch (559 mm).
 - b. Tall Cabinets: 22 inch (559 mm).
 - c. Upper Cabinets: 16 inch (406 mm).
 4. Steel Sheet Metal:
 - a. Gables, Front and Back Panels, Gusset Plates, Aprons, and Rails: 18 gauge, 0.0478 inch (1.21 mm) minimum thickness.
 - b. Drawers, Cabinet Floors, Shelves, Filler Panels and Drawer Dividers: 20 gauge, 0.0359 inch (0.91 mm) minimum thickness.
 - c. Backing Sheet to Door and Door Fronts: 22 gauge, 0.0299 inch (0.76 mm) minimum thickness.
 5. Structural Performance: In addition to the requirements of SEFA 3, SEFA 7 and SEFA 8M, provide components that safely support the following minimum loads, without deformation or damage:
 - a. Base Units: 500 pounds per linear foot (744 kg/linear m) across the cabinet ends.
 - b. Drawers: 150 pounds (68 kg).
 - c. Hanging Upper Cases: 300 pounds (136 kg).
 6. Corners and Joints: Without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
 7. Edges and Seams: Smooth. Form counter tops, shelves, and drain boards from continuous sheets.
 8. Shelf Edges: Turned down 3/4 inch (19 mm) on each side and returned 3/4 inch (19 mm) front and back.
 9. Ends: Close open ends with matching construction.
 10. Welding: Electric spot welded; joints ground smooth and flush.
 11. Drawers and Doors: Fabricate drawer and door fronts of sandwiched sheets of sheet steel welded together and reinforced for hardware.
 - a. Fill with sound-deadening core.
 12. Shelves: Adjustable and fixed shelves formed down 3/4 inch (19 mm), returned back 7/8 inch (22 mm), and up 1/4 inch (6 mm) into a channel shape, front and rear; formed down 3/4 inch (19 mm) at each end. Shelves over 42 inches (1067 mm) long reinforced with a channel welded to underside of shelf.
 13. Glazing: Type and thickness standard with manufacturer.

- a. Framed Doors: Tempered glass, with gaskets and removable stops; minimize rattling and vibration.
- 14. Fittings and Fixture Locations: Cut and drill countertops, backs, and other casework components for service outlets and fixtures.
- 15. Access Panels: Where indicated, for maintenance of utility service fixtures and fittings and mechanical and electrical components.
- 16. Removable back panels on all base cabinets. Partial height back panels at sink cabinets.
- 17. Fixed panels at backs of open spaces between base cabinets and at ends of utility spaces not otherwise enclosed.
- 18. Scribe Panels: Similar to filler panels, except flanges on one side and flat on the other, of matching construction and finish.
- 19. Sloped Tops for Upper and Floor Cabinets: 20 gauge, 0.0359 inch (0.91 mm) minimum, with closed ends, flanged to allow attachment to cabinet(s) below.
- 20. Surface Finish on Sheet Steel: With chemical resistance equal to Level 0 (no change) or Level 1 (slight change of gloss or slight discoloration) according to SEFA 8M. Test applied finishes using procedures specified in ASTM D522/D522M.
- 21. Stainless Steel Finish: No.4, brushed finish.
- 22. Separation: Use bituminous paint or non-conductive tape to coat metal surfaces in contact with cementitious materials, and to separate dissimilar metals.
- B. Acid Storage Cabinets: Construction identical to other cabinets, with following exceptions:
 - 1. Completely lined with corrosion-resistant liner material; stainless steel fasteners for all connections and hardware inside cabinet.
 - 2. Shelves: Perforated or vented, rigid polypropylene.
 - 3. Bottom Pan: Liquid tight, polypropylene liner covering entire bottom of acid storage cabinet.
 - 4. Vents: Comply with SEFA 1.
 - a. Locate acid storage cabinet vents in accordance with manufacturer's instructions.
 - b. Vent base cabinets through work surface with manufacturer's vent kit.
 - c. Seal penetrations with chemical resistant sealant.
- C. Solvent (Flammable and Combustible Liquids) Storage Cabinets: Construction identical to other cabinets, with following exceptions:
 - 1. Construct to NFPA 30 and applicable OSHA requirements.
 - 2. Comply with SEFA 11.
 - 3. Fire Resistance: Maximum internal temperature of 325 degrees F (163 degrees C) at the center, and 1 inch (25.4 mm) from top of the cabinet when cabinet is subjected to a ten minute fire test that simulates fire exposure of a standard time-temperature curve specified in ASTM E119.
 - 4. Steel sheet, 18 gauge, 0.0478 inch (1.21 mm) minimum thickness, double panel construction with 1-1/2 inch (38 mm) space between panels and electrical grounding connection.
 - 5. Shelves: Full depth, adjustable sloped metal shelf.
 - 6. Bottom Pan: 2 inches (50.8 mm) deep liquid-tight pan covering entire bottom of cabinet.
 - 7. Cabinet Hardware: UL-listed.
 - 8. Vents: Provide venting capable of achieving at least ten air changes per hour.
 - a. Tie into building lab exhaust system.
 - b. Vent Connections: 1-1/2 inch (38 mm) minimum diameter, corrosion resistant piping having flame spread index of 25 or less, when tested in accordance with ASTM E84.
 - c. Provide minimum of two vents with fire arrestors for each cabinet.
 - 9. Signage: Provide manufacturer's standard signage reading "FLAMMABLE - KEEP FIRE AWAY" or similar message in bright red color.
- D. Apron Assemblies: Construction similar to other cabinets, fabricated from metal channel-shaped skirting panels.

1. Assemblies consisting of front and back panels, with drawer suspension framing mechanically fastened to support channels. Weld support channels to skirting panels to form a riding one-piece frame.
 2. Apron Drawers: Manufacturer's standard drawer construction and size for apron installation. Single drawer for aprons up to 48 inches (1219 mm) wide, two drawers for wider aprons.
- E. Countertop Panel-Type Supports: Materials similar to adjacent casework, 1-1/2 inch (38 mm) in width, with front-to-back and toe space dimensions matching base cabinet. Designed to be secured in a concealed fashion to countertop material. Include two leveling devices per support panel.

2.03 CABINET HARDWARE

- A. Manufacturer's standard styles, and as indicated below.
- B. Comply with BHMA A156.9 requirements.
1. Acceptable base materials for plated finishes include brass, bronze, and steel.
- C. Finish of exposed stainless steel components: No.4 finish.
- D. Locks: On casework drawers and doors, where indicated. Lock with 5 pin cylinder and 2 keys per lock.
1. Hinged Doors: Cam type lock, bright chromium plated over nickel on base material.
 2. Tall Hinged Doors: Three-point latching system.
 3. Keying: Key locks alike within a space; key each room separately.
- E. Shelves in Cabinets:
1. Shelf Standards and Rests: Vertical standards with rubber button fitted rests, satin chromium plated over nickel on base material.
- F. Swinging Doors:
1. Hinges: Offset pin, number as required by referenced standards for width, height, and weight of door.
 - a. Butt Hinges for Inset Doors: five-knuckle, projecting barrel, minimum 2-1/2 inches long (five-knuckle, projecting barrel, minimum 64 mm long). Stainless steel with No.4 finish.
 2. Catches: Magnetic.
 3. Pulls: Rectangular brushed aluminum, 4 inches (102 mm) 4 inches (102 mm) wide.
- G. Drawers:
1. Pulls: Rectangular brushed aluminum, 4 inches wide (102 mm wide).
 2. Slides: Steel, full extension arms, ball bearings; self-closing; capacity as recommended by manufacturer for drawer height and width.

2.04 WORKBENCHES (TABLES)

- A. Workbenches:
1. Manufacturers:
 - a. Formaspace, Basix.
 - b. Hamilton Laboratory Solutions.
 - c. BOSTONtec.
 2. Substitutions: See Section 01 2500 - Substitution Procedures. Submit evidence that the proposed substitution complies with the specified requirements.
- B. Tables: Include fixed and adjustable height units and lower shelf where indicated.
1. Fixed Height Table Construction: Manufacturer's standard, with manufacturer's standard material countertops, unless noted otherwise.
 2. Table Bracing: Removable tube members, in size standard with the manufacturer, installed between legs in manufacturer's standard configuration. Removable bracing designed to be mechanically fixed to concealed U-shaped mounting tabs that are integral with each leg.
 3. Table Frame: Heavy-Duty, 2 inch tubular steel. Welded frame construction.

4. 3/8 inch (10 mm) leveling devices.
- C. Mobile tables constructed the same as fixed tables, except with table legs designed to receive swivel casters.
- D. Load Capacity: Up to 1,500 Lbs
- E. Worksurface (top): Epoxy Resin -1 inch.
- F. Lower Shelf:
 1. Full Depth, Epoxy Resin - 1 inch. Refer to drawings for location (M-WB1)
 2. No shelf - Refer to drawings for location (M-WB2)
- G. Size:
 1. Width: Refer to drawings
 2. Depth: Refer to Drawings
- H. Feet: Adjustable Height Leg.
 1. Caster wheels, locking - 300 lbs. (mobile tables).
 2. Heavy Duty-Anti Vibration Levelers -500 lbs. (fixed tables),
- I. Metal Finish: Finish, surface color, and texture: As selected by Architect from manufacturer's standard line.

2.05 COUNTERTOPS

- A. Countertops:
 1. Epoxy Resin Countertops: Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.
 - a. Flat Surface Thickness: 1 inch (25 mm), nominal.
 - b. Surface Finish: Smooth, non-glare.
 - c. Color: Black.
 - d. Exposed Edge Shape: 1/8 inch (3 mm) bevel chamfer.
 - e. Drip Edge: Drip groove 1/8 inch (3 mm) wide and deep, located 1/2 inch (12 mm) back from edge on underside of each exposed edge.
 - f. Back and End Splashes: Same material, same thickness; separate for field attachment.
 - g. Fabricate in accordance with manufacturer's standard requirements.

2.06 SINKS

- A. Laboratory sinks.
 1. General: Sinks with perimeter lip for drop-in installation.
 2. Sink types and sizes are indicated on drawings.
 3. Strainers by sink manufacturer.
 4. Cup Sink: Epoxy, with waste fitting.
 - a. Shape: Oval.
 - b. Size: As indicated on Drawings.
- B. Non-laboratory sinks are identified on drawings and are specified in Section 22 4000.

2.07 PEGBOARDS

- A. Epoxy resin pegboards with pre-drilled or punched holes in a staggered pattern, designed to accept removable white polypropylene pegs. With each pegboard include a stainless steel drip-trough with drain outlet and matching diameter 36 inch (914 mm) long PVC drain hose.
 1. Size: 30 inches wide by 30 inches high (762 mm wide by 762 mm high).

2.08 MATERIALS

- A. Sheet Steel: High-strength low-alloy, cold rolled and leveled unfinished steel sheet, ASTM A1008/A1008M, Class 1 (matte) finish.
- B. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, CS or FS Type B, with G90/Z275 coating; stretcher leveled.
- C. Stainless Steel Sheet: ASTM A666/A666M, Type 304.
- D. Solid Epoxy Resin: Modified epoxy resin and non-asbestos inert fillers cast into sheets.
- E. Glass: Fully tempered float; ASTM C1036, Type 1, Quality Q3; ASTM C1048, tempered using horizontal tempering and complying with ANSI Z97.1; 3/16 inch (4.5 mm) thick minimum; exposed edges ground, and cut or drilled to receive hardware; clear.

2.09 FINISHES

- A. Sheet Steel Finish: Having chemical resistance equal to Level 0 (no change) or Level 1 (slight change of gloss or slight discoloration) according to SEFA 8M. Test applied finishes using procedures specified in ASTM D522/D522M.
 - 1. Coating Type, New Casework: Baked on epoxy; minimum two coats.
 - 2. Color: As selected from manufacturer's standard selection.
 - 3. Preparation: Degrease and phosphate etch, and prime.
- B. Stainless Steel Finish: No.4, brushed finish.

2.10 ACCESSORIES

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of support framing and anchors.
- B. Verify that service connections are correctly located and of proper characteristics.

3.02 INSTALLATION

- A. Perform installation in accordance with manufacturer's instructions and with SEFA 2.
- B. Large Components: Ensure that large components can be moved into final position without damage to other construction.
- C. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.
- D. Set casework items plumb and square, securely anchored to building structure, with no distortion.
 - 1. Base Cabinets: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 3/4 inch (19 mm) leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.
 - 2. Wall Cabinets: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
- E. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.
- F. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch (1.6 mm). In addition, do not exceed the following tolerances:
 - 1. Variation of Tops of Base Cabinets from Level: 1/16 inch (1.6 mm) in 10 feet (3 m).

2. Variation of Faces of Cabinets from a True Plane: 1/8 inch (3 mm) in 10 feet (3 m).
 3. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
 4. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.6 mm).
- G. Secure upper and floor cabinets to concealed reinforcement at gypsum board assemblies.
- H. Separate dissimilar metals to prevent galvanic action.
- I. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches (407 mm) on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
1. Where base cabinets are installed away from walls or service space framing, anchor to floor at toe space at not more than 24 inches (610 mm) on center, and at sides of cabinets with not less than two fasteners per side.
- J. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches (407 mm) on center.
- K. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.
- L. Vented Cabinets: Install in strict compliance with manufacturer's written installation instructions.
1. Install vent kits and connect to exhaust system.
 2. Use only rigid materials for venting. No flexible materials permitted.
- M. Replace units that are damaged, including those that have damaged finishes.
- N. Deliver sinks, cup sinks, and service fittings in properly marked boxes, accompanied with written instructions, for supervised installation by appropriate trade contractor(s).
- O. Coordinate the installation of plumbing fixtures, service fittings, and emergency equipment specified by the plumbing divisions.

3.03 ADJUSTING

- A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.04 CLEANING

- A. Clean casework and other installed surfaces thoroughly.

3.05 PROTECTION

- A. Do not permit finished casework to be exposed to continued construction activity.
- B. Protect casework and countertops from ongoing construction activities. Prevent installers from standing on or storing tools and materials on casework or countertops.
- C. Repair damage that occurs prior to Date of Substantial Completion, including finishes, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

SECTION 12 3553.23
SOLID-PLASTIC LABORATORY CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Standard and custom solid-plastic cabinets and cabinet hardware.
- B. Epoxy Resin Countertops.
- C. Laboratory sinks.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 06 1000 - Rough Carpentry: Blocking and nailers for anchoring casework.
- C. Section 09 6500 - Resilient Flooring: Resilient wall base.
- D. Section 12 13553.13 - Metal Laboratory Casework - for other casework and epoxy resin countertops.
- E. Section 22 4200 - Plumbing Fixtures: Non-laboratory sink, service fittings, and emergency equipment.
- F. Section 22 4300 - Healthcare Plumbing Fixtures: Additional emergency equipment.
- G. Section 26 0533.23 - Surface Raceways for Electrical Systems: Surface raceway systems.

1.03 REFERENCE STANDARDS

- A. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- B. ASTM C1036 - Standard Specification for Flat Glass; 2025.
- C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.
- D. ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials; 2017, with Editorial Revision (2019).
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- F. BHMA A156.9 - Cabinet Hardware; 2020.
- G. SEFA 1 - Laboratory Fume Hoods; 2010.
- H. SEFA 2 - Installations; 2010.
- I. SEFA 3 - Laboratory Work Surfaces; 2020.
- J. SEFA 7 - Laboratory Fixtures; 2021.
- K. SEFA 8P - Laboratory Grade Polypropylene Casework; 2014.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Service Fixtures: Coordinate location and characteristics of service connections.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors and reinforcements placement dimensions and tolerances, clearances required, and utility locations, if any. Include coordinated information for laboratory equipment specified in another section and/or furnished by Owner.
- C. Samples For Color Selection: Color charts for each different finish material.
- D. Test Reports: Independent laboratory reports showing compliance with chemical and physical resistance requirements for casework finish.
- E. Maintenance Data: Manufacturer's recommendations for care and cleaning.
- F. Finish touch-up kit for each type and color of materials provided.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of documented experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. Use polyethylene film or other protective material standard with the manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Solid-Plastic Laboratory Casework:
 - 1. BNT/ Nelson Casework.
 - 2. JHC Fabrication.
 - 3. LOC Scientific.
- B. Countertops:
 - 1. Durcon (Epoxy resin, Solid phenolic); Basis-of-Design.
- C. Sinks and Cup Sinks:
 - 1. Durcon (Epoxy resin); Basis-of-Design.
- D. Obtain casework from single source and manufacturer, unless otherwise indicated.

2.02 SOLID-PLASTIC LABORATORY CASEWORK

- A. Casework: Solid-plastic, each unit self-contained and not dependent on adjacent units or building structure for rigidity; factory-fabricated, factory-assembled, and factory-finished.
 - 1. Style: Inset - square edge.
 - 2. Primary Cabinet Material: Stress-relieved solid polypropylene or phenolic resin.
 - a. Plastic sheets laminated to metal or wood substrates are not acceptable.
 - b. Finish: Manufacturer's standard smooth/smooth surface polypropylene or phenolic sheets and components.
 - 1) Color: As selected from manufacturer's standard.
 - 3. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions.
 - a. Base Cabinets: 22 inch (559 mm).

- b. Tall Cabinets: 22 inch (559 mm).
- c. Upper Cabinets: 16 inch (406 mm).
- 4. Structural Performance: In addition to the requirements of SEFA 3, SEFA 7 and SEFA 8P, provide components that safely support the following minimum loads, without deformation or damage:
 - a. Base Units: 400 pounds per linear foot (595.3 kg/linear m) across the cabinet ends.
 - b. Drawers: 150 pounds (68 kg).
 - c. Hanging Upper Cases: 300 pounds (136 kg).
- 5. Corners and Joints: Without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
- 6. Edges and Seams: Smooth. Form counter tops, facing, shelves, and drain boards from continuous sheets of material.
- 7. Welding: Hot-air, full-seam welding.
- 8. Drawers and Doors: Fabricate drawer and door fronts of same materials as cases.
- 9. Shelves: Adjustable and fixed shelves of same material as cases.
- 10. Glazing: Type and thickness standard with manufacturer.
 - a. Framed Doors: Tempered glass, with gaskets and removable stops; minimize rattling and vibration.
- 11. Fittings and Fixture Locations: Cut and drill countertops, backs, and other casework components for service outlets and fixtures.
- 12. Access Panels: Where indicated, for maintenance of utility service fixtures and fittings and mechanical and electrical components.
- 13. Removable back panels on all base cabinets. Partial height back panels at sink cabinets.
- 14. Fixed panels at backs of open spaces between base cabinets and at ends of utility spaces not otherwise enclosed.
- 15. Filler Panels: Of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.
- 16. Scribe Panels: Similar to filler panels, of matching construction and finish.
- 17. Sloped Tops for Upper and Floor Cabinets: Of matching construction and finish, designed to allow attachment to cabinet(s) below.

2.03 CABINET HARDWARE

- A. Manufacturer's standard styles.
- B. Comply with BHMA A156.9 requirements.
- C. Label Holders: Manufacturer's standard materials, size, and mounting, for drawer fronts and cabinet doors indicated.
- D. Swinging Doors:
 - 1. Hinges: Manufacturer's standard, non-metallic hinges and fasteners.
 - 2. Catches: Polyethylene coated magnets embedded in door and frame.
 - 3. Pulls: Polypropylene, wire pulls 4 inches (102 mm) wide.
- E. Drawers:
 - 1. Pulls: Polypropylene wire pulls, 4 inches wide (102 mm wide).

2.04 COUNTERTOPS

- A. Countertops: Manufacturer's standard worksurfaces, compatible with casework, and complying with requirements of SEFA 3.
 - 1. Epoxy Resin Countertops: Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.
 - a. Flat Surface Thickness: 1 inch (25 mm), nominal.
 - b. Surface Finish: Smooth, non-glare.

- c. Color: Black.
- d. Exposed Edge Shape: 1/8 inch (3 mm) bevel chamfer.
- e. Back and End Splashes: Same material, same thickness; separate for field attachment.
- f. Fabricate in accordance with manufacturer's standard requirements.

2.05 SINKS

- A. Laboratory sinks.
 - 1. General: Manufacturer's adjustable support system for undermount sink installation.
 - 2. Sink types and sizes are indicated on drawings.
 - 3. Strainers by sink manufacturer.

2.06 MATERIALS

- A. Polypropylene: Sheets and shapes, ASTM D4101.
- B. Solid Epoxy Resin: Modified epoxy resin and non-asbestos inert fillers cast into sheets.
- C. Glass: Fully tempered float; ASTM C1036, Type 1, Quality Q3; ASTM C1048, tempered using horizontal tempering and complying with ANSI Z97.1; 3/16 inch (4.5 mm) thick minimum; exposed edges ground, and cut or drilled to receive hardware; clear.
- D. Phenolic Panels: Monolithic core of phenolic resin reinforced with cellulose fibers and manufactured under high pressure and at high temperatures, with melamine-impregnated decorative surface papers; NEMA LD 3 Compact Laminate, Grade CGS.
- E. Sealant For Use in Casework Construction: Manufacturer's recommended type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of support framing and anchors.
- B. Verify that service connections are correctly located and of proper characteristics.

3.02 INSTALLATION

- A. Perform installation in accordance with manufacturer's instructions and with SEFA 2.
- B. Large Components: Ensure that large components can be moved into final position without damage to other construction.
- C. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.
- D. Set casework items plumb and square, securely anchored to building structure, with no distortion.
 - 1. Base Cabinets: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 3/4 inch (19 mm) leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.
- E. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.
- F. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch (1.6 mm). In addition, do not exceed the following tolerances:
 - 1. Variation of Tops of Base Cabinets from Level: 1/16 inch (1.6 mm) in 10 feet (3 m).
 - 2. Variation of Faces of Cabinets from a True Plane: 1/8 inch (3 mm) in 10 feet (3 m).
 - 3. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).

- 4. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.6 mm).
- G. Secure upper and floor cabinets to concealed reinforcement at gypsum board assemblies.
- H. Service Space Framing: Anchor to floor with two fasteners at each frame. Fasten to wall substrates.
- I. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches (407 mm) on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
- J. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches (407 mm) on center.
- K. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.
- L. Replace units that are damaged, including those that have damaged finishes.
- M. Deliver sinks in properly marked boxes, accompanied with written instructions, for supervised installation by appropriate trade contractor(s).
- N. Coordinate the installation of plumbing fixtures, service fittings, and emergency equipment specified by the plumbing divisions.

3.03 ADJUSTING

- A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.04 PROTECTION

- A. Do not permit finished casework to be exposed to continued construction activity.
- B. Protect casework and countertops from ongoing construction activities. Prevent installers from standing on or storing tools and materials on casework or countertops.
- C. Repair damage that occurs prior to Date of Substantial Completion, including finishes, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

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**SECTION 12 3600
COUNTERTOPS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Solid Surface Countertops for architectural cabinet work.
- B. Window Sills.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 06 4100 - Architectural Wood Casework.
- C. Section 06 6100 - Cast Polymer Fabrications: For solid surface wall panels and shower receptors with surrounds.
- D. Section 12 3553.13 - Metal Laboratory Casework: Laboratory countertops.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2022.
- B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- E. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- G. PS 1 - Structural Plywood; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- F. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD 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 absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
 - 1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
 - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - b. Color and Pattern: As indicated on drawings.
 - 3. Other Components Thickness: 1/2 inch (12 mm), minimum.
 - 4. Exposed Edge Treatment: Built up to minimum 1-1/2 inch (38 mm) thick; radiused edge.
 - 5. Back and End Splashes: Same sheet material, radiused top; minimum 4 inches (102 mm) high.
 - 6. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

2.02 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
- B. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf (20 kg/cu m) minimum density; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
- C. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
- D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.

2. Height: 4 inches (102 mm), unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
 1. Integral sinks: Shop-mount securely to countertop with adhesives, using flush configuration, as per manufacturer's instructions, and as detailed on drawings.
- D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install vanities in accordance with manufacturer's instructions and approved shop drawings
- B. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.
- B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.
- C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.05 CLEANING

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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**SECTION 13 2126
COLD STORAGE ROOMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Prefabricated insulated cold storage rooms with wall, floor, and ceiling panels.
- B. Door, frame, and hardware.
- C. Roof mounted condensing unit.
- D. Self contained refrigeration unit.
- E. Controls and lighting.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 07 9200 - Joint Sealants: Sealing between cold storage room enclosure and adjacent construction.
- C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- B. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- E. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- F. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
- G. NSF 7 - Commercial Refrigerators and Freezers; 2024.
- H. NEMA MG 00001 - Motors and Generators; 2024.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. PS 1 - Structural Plywood; 2023.
- K. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination with Electrical: Coordinate location and characteristics of electrical service.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on hardware and fixtures, joint details.

- C. Shop Drawings: Indicate layout, room dimensions, materials, components, fasteners, doors, hardware, equipment, finishes, method of installation and assembly, panel placement, supplementary structural support or bracing, controls, and service rough-in.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention .
- E. Manufacturer's Qualification Statement.
- F. Operation Data: Include operating equipment, service and lubrication schedules .
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Wrap and crate finished components and assemblies at factory to prevent damage or marring of surfaces during shipping and handling.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for remote refrigeration compressor unit.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cold Storage Rooms:
 - 1. American Walk-in Coolers (AWIC); Basis-of-Design, or approved equal.
 - 2. Rep. Contact: Dennis Igou, Phone: (520) 906-8556
Email: dennis@americanwalkincoolers.com
 - 3. Substitutions: See Section 01 2500 - Substitution Procedures. Submit evidence that the proposed substitution complies with the specified requirements.

2.02 COLD STORAGE ROOMS

- A. Cold Storage Rooms: Factory-fabricated packaged units, comprised of modular panels, equipment, and fittings.
 - 1. Exposed components are noncombustible.
 - 2. Food Service Applications: Comply with NSF 7.
 - 3. Electrical Equipment: Listed and classified by UL (DIR) as suitable for purpose specified and as indicated on drawings.

2.03 PERFORMANCE REQUIREMENTS

- A. Wall Panels: Withstand live lateral load of 100 lbs (450 N) point load, and 5 psf (239 Pa) uniform load.
- B. Ceiling Panels: Withstand their own weight, dead loads, and live loads of 15 psf with maximum deflection of 1:180.
- C. Floor Panels: Support uniformly distributed loads of 1200 Lbs.without physical damage or indentation of panel or insulation. a

- D. Cooler Rooms: Maintain 35 degrees F (2 degrees C).
- E. Air Leakage: Limit air leakage through assembly to 0.06 cu ft/min sq ft (0.3 L/sec sq m) of wall area, with pressure difference across assembly of 1.57 psf (75 Pa) in accordance with ASTM E283/E283M.

2.04 COMPONENTS

- A. Wall Panels:
 - 1. Exterior Sheet (front exposed panels): 24 ga. minimum thickness, painted galvanized steel.
 - 2. Core: Urethane Insulation bonded to exterior and interior sheets (R-32).
 - 3. Panel Assembly: Tongue and groove edges, integral cam action locking clamps spaced maximum of 40 inch (1016 mm) on center.
- B. Ceiling Panels: Same construction as walls except exterior sheets sheet steel.
- C. Floor Panels:
 - 1. Top Sheet: 22 ga. minimum thickness, stainless steel.
 - 2. Core: 5/8 inch (16 mm) thick exterior grade plywood laminated between top sheet and insulation; all bonded.
 - 3. Panel Assembly: 3 1/2 inches, high density urethane. Tongue and groove edges, integral cam action locking clamps spaced maximum of 40 inch (1016 mm) on center.
- D. Insulation Thickness: 4 inch (101.6 mm) minimum.
- E. Doors: Overlap type for 36 by 78 inch minimum opening, similar construction of walls with edges closed; 2-1/2 inch (63.5 mm) thick insulation. Self closing with view window.
- F. Hardware: Cast brass, nylon bearing self closing hinges, roller catch latch and keeper; cylinder lock and inside safety release mechanism.
- G. Door Gaskets: Resilient hollow neoprene; organic grease and oil resistant, replaceable and adjustable, concealed magnetic strip to maintain air tight seal.
- H. View Windows: 12 inch x 12 inch min. Sealed insulating glass units in doors.
- I. Interior floor ramp.
- J. Light Fixtures: Vapor tight, incandescent with 150 watt lamp, operating toggle switch on exterior wall of room with pilot light, wired in rigid conduit.

2.05 MATERIALS

- A. Aluminum: ASTM B209/B209M sheet.
 - 1. Smooth Surface: 0.050 inch (1.3 mm) minimum thickness.
 - 2. Stucco Embossed Surface: 0.042 inch (1.06 mm) minimum thickness.
- B. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating; 0.030 inch (0.76 mm) minimum thickness.
- C. Stainless Steel Sheet: ASTM A666/A666M Type 304; No.4 finish, 0.0375 inch (0.95 mm) minimum thickness.
- D. Insulation: Polyurethane foamed-in-place, density 2.2 lb/cu ft (61 g/cu m), K factor of 0.12 (ksi factor of 0.02), self extinguishing type.
- E. Accessories: Thresholds, closure plates, ramps, hanger rods, tie down plates, bolts, screws, and washers; noncorrosive.
- F. Insulating Glass Units (IGU): Hermetically sealed double pane units, 1/4 inch (6 mm) thick lights, clear tempered glass panes, 5/8 inch (16 mm) unit thickness; certified by independent testing agency to comply with ASTM E2190.
- G. Plywood: PS 1 Grade C-D sanded, preservative treated for fungus resistance.

- H. Sealant: ASTM C920, elastomeric sealant capable of performing under long-term cold temperature exposure. See Section 07 9200 for additional requirements.

2.06 EQUIPMENT

- A. Cooling System: Direct expansion refrigerant, air cooled; remote located condensing unit for one rooms, evaporator, unit cooler, self contained with valves, controls, switches, timers, refrigerant piping, insulated suction lines, and wiring. Size and capacity to maintain environment specified; electric defrost ; electrically heated trace condensate drain.
- B. Electrical Characteristics (Condensing Unit):
 - 1. 1.25 HP
 - 2. {CH#74480} volts, {CH#74481} phase, 60 Hz.
 - 3. See electrical drawings for connections.
- C. Control Panel: Provide with alarms, and controls at door of each room.
- D. Thermometer: Direct reading type.
- E. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to NFPA 70.
- F. Disconnect Switch: Factory mount disconnect switch in control panel.

2.07 FINISHES

- A. Exterior Galvanized Steel Cladding: White color (front exposed panels).
- B. Interior Galvanized Steel Cladding: White color.
- C. Stainless Steel: No.4 Brushed finish.
- D. Hardware: Polished chrome.
- E. Flooring: Smooth stainless steel. Type 304, #4.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces, prepared openings, and roughed-in utilities are ready to receive work and opening dimensions are as indicated on drawings.

3.02 INSTALLATION

- A. Assemble and install components in accordance with manufacturer's instructions.
- B. Set wall attachments on floor and anchor securely. Align over insulated break of recessed insulated floor slab.
- C. Cut holes, install anchors, and seal room panels for plumbing, power, and lighting.
- D. Assemble wall panels; lock in place with cam locks, and brace securely until ceiling panels are installed.
- E. Install ceiling panels; lock into wall panels. Provide and install supplementary ceiling hanger supports to building structure above.
- F. Install sill plate at door opening and heated thresholds and ramps.
- G. Hang doors, and adjust to operate smoothly.
- H. Locate condensing unit for each room on top of roof above door, support coil on room interior and make connections as required. Wire-in alarm unit and door and threshold heaters. Connect units to valved water piping and run condensate line to nearest drain.

- I. Install ceiling trim, ceiling fascia, cover plates between top of room and finished ceiling and end closure plates between room and adjacent wall.
- J. Seal joints and services through walls with sealant to provide moisture and vapor seal.

3.03 FIELD QUALITY CONTROL

- A. Test and adjust control equipment to ensure performance complies with specified requirements.
- B. Operate each room and test full range of functions over a continuous 48 hour period, recording physical data on operating equipment. Continuously record temperature and humidity.
- C. Test each room for air tightness.

3.04 CLEANING

- A. Remove temporary protection from prefinished surfaces.
- B. Wash and clean floor, walls, and ceiling inside room and exposed surfaces on the outside.

3.05 CLOSEOUT ACTIVITIES

END OF SECTION

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DIVISION 21 FIRE SUPPRESSION

21 0000 General Requirements for Fire Suppression Systems

- 21 0001 Basic Fire Suppression Requirements
- 21 0002 Fire Suppression Work in Existing Buildings
- 21 0004 Firestopping for Fire Suppression Systems

21 0500 Common Work Results for Fire Suppression

- 21 0513 Electrical Requirements for Fire Suppression Equipment
- 21 0519 Meters and Gauges
- 21 0529 Pipe Hangers and Supports
- 21 053 Equipment Bases and Supports
- 21 0553 Identification for Fire Suppression Systems

21 1000 Water Based Fire Suppression Systems

- 21 1313 Wet-Pipe Sprinkler Systems
- 21 1316 Dry-Pipe Sprinkler Systems

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SECTION 21 0001 – BASIC FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section Includes the following:
 - 1. General Requirements
 - 2. Definitions
 - 3. Scope of Work
 - 4. Drawings and Specifications
 - 5. Reference Standards
 - 6. Site Visit
 - 7. Permits and Regulations
 - 8. Project Management and Coordination
 - 9. Workmanship
 - 10. Protection
 - 11. Painting
 - 12. Cleaning
 - 13. Equipment Selection
 - 14. Shop Drawings
 - 15. Final Inspection and Punch List
 - 16. Operation and Maintenance Manuals
 - 17. Record Drawings
 - 18. Warranties
 - 19. Project Closeout
 - 20. Operation and Adjustment of Equipment
 - 21. Operating Demonstration and Instruction
 - 22. Build America, Buy America Act Requirements

1.2 GENERAL REQUIREMENTS

- A. All provisions of Division 00 Front End Documents and Division 01 General Requirements apply to work specified in this Division.
- B. Specification provisions of other relevant Divisions shall apply where applicable work is required to be performed under this Fire Suppression work.
- C. A complete and functional Fire Suppression system installation shall be provided under this Division. Should overlap of work among trades become evident, this shall be called to the attention of the architect. In such event, none of the trades or their suppliers shall assume that he relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

- D. The Fire Suppression, Plumbing, HVAC and Electrical drawings and specifications assign work (labor and/or materials) to be provided by the General, Fire Suppression, Plumbing, HVAC or Electrical Contractor or their sub-contractors. Understanding that the contractors for mechanical and electrical work are sub-contractors to the (General) Contractor, such assignments are not intended to restrict the General Contractor in assignment of work among the sub-contractor to accommodate trade agreements and practices or the normal conduct of the construction work.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, 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.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior 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.

1.4 SCOPE OF WORK

- A. The scope of the Fire Suppression work includes furnishing, installing, testing and warranty of all Fire Suppression work shown on the Fire Suppression drawings and specified herein, including Division 00, division 01, Division 21 and applicable provisions of other relevant Divisions.

1.5 DRAWINGS AND SPECIFICATIONS

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word “proved,” as used, shall mean “furnish and install.” If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect for approval before proceeding with the work.
- B. Make all necessary field measurements to ensure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having pipe and fittings fabricated and

delivered in advance of making actual measurements shall be sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.

- D. The Architect shall reserve the right to make minor adjustment in locations of system runs and components where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties.
- E. Equipment, or piping shall not be installed or run above electrical switchgear or panelboards, nor in or above the access space in the immediate vicinity of the electrical switchgear/panelboards, in accordance with NEC Article 384.
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Architect's decision shall be final in regard to the arrangement of ductwork, piping, etc., where conflict arises.
- G. Provides offsets in system runs, additional fittings, necessary drains and minor valves, traps, and devices required to complete the installation, or for the proper operation of the system. Each Contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

1.6 REFERENCE STANDARDS

- A. Where standards (NFPA, NEC, ADTM, UL, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the authority having jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

1.7 SITE VISIT

- A. Refer to Sections 017300 Execution.
- B. Each bidder shall visit the project site to understand the existing conditions and compare the conditions with information shown on the drawings. Report immediately to the Architect any issues or discrepancies which are discovered that affect the bid. Changes to contract price will not be considered for site condition issues that are readily apparent from a thorough site review.

1.8 PERMITS, REGULATIONS AND INSPECTION

- A. Work must conform to applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawing and specifications shall govern. Install no work contrary to minimum legal standards.
- B. The fire suppression contractor shall be responsible to prepare a permit set of documents to file for and obtain all required permits from the governing inspection agencies. Include payment of all permit and inspection fees applicable to the work in this Division.
- C. All work shall be subject to inspection and approval of Federal, State and local agencies as may be appropriate as well as the Architect and Engineer.
- D. Furnish for the Owner certificates of approval from the governing inspection agencies as a condition for final payment.

1.9 PROJECT MANAGEMENT AND COORDINATION

- A. Refer to Section 013100 Project Management and Coordination.
- B. The HVAC Contractor shall initially prepare and be responsible for 1/4" scale coordination drawings. These drawings shall be reproduced and distributed to the Fire Suppression, Plumbing and Electrical Contractors for their input and revisions. Work together with all contractors to obtain finish coordinated drawings. No work shall be installed until all contractors have approved and signed-off with their approval and drawings have been submitted and reviewed by the Engineer.

1.10 WORKMANSHIP

- A. Refer to Section 014000 Quality Requirements.
- B. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Architect shall have the right to stop the work if highest quality workmanship is not maintained.
- C. Fire suppression design and work shall be performed by licensed Fire Suppression Contractors in accordance with requirements of the jurisdiction.

1.11 PROTECTION

- A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect.
- B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide plastic sheeting, drop cloths or similar barriers where dust and debris is generated, to protect adjacent areas.

- C. Contractor shall protect all equipment and materials from detrimental effects of weather or construction activity. All items shall be stored and secured in a protected location away from the daily work area. Equipment or materials shall be placed on raised skids to protect from surface moisture. Where appropriate, provide plastic sheeting or similar vapor barrier underneath the stored products to reduce the effects of ground moisture or curing concrete on the local humidity levels. Where unfinished ferrous products or finished ferrous products with raw edges are stored, provide local, dry heat to maintain ambient relative humidity levels below 65% RH to prevent rust.
- D. All equipment shall retain the original packaging until required to be removed for installation or operation. Open ends of piping, conduit, etc. shall be capped or sealed and ventilation openings into equipment shall be wrapped and sealed in plastic sheeting to prevent dust or dirt entry both when stored and after installation but still open to the effects of construction activity. Stored items as well as installed equipment shall be covered with plastic sheeting at all times until placed in service or until dust generating activity in the area has ceased.

1.12 PAINTING

- A. In addition to any painting specified for various individual items of equipment, the following painting shall be included in Division 21:
 - 1. Ferrous metal which is not factory or shop painted or galvanized, and which remains exposed to view in the building including finished areas, mechanical rooms, storage rooms, and other unfinished areas shall be given a prime coat of paint.
 - 2. Ferrous metal installed outside the building which is not factory or shop painted or galvanized shall be given a prime coat of paint.
 - 3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch-up.
- B. Paint, surface preparation and application shall conform to applicable portions of the Painting section of Division 09 Finishes. All rust must be removed before application of paint.
- C. Finish painting is included in the General Contract except where otherwise required under remodeling work.

1.13 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.

- C. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain. The contractor shall also clean duct interiors and interior components of new or existing air handling system equipment if dirt, dust or debris have generated in the course of work have accumulated on these surfaces.

1.14 EQUIPMENT SELECTION

- A. Materials and equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer. The selection of materials and equipment to be furnished under this contract shall be governed by the following:
 - 1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specifications, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturer's listed.
 - 2. Where the words "or approved equal:" appear after a manufacturer's name, specific approval must be obtained from the Architect during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
 - 3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish a model or series designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval.
- B. Substitute equipment of equal quality and capacity will be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.
- C. Before bidding equipment, and again in the preparation of shop drawings the Contractor and his supplier shall verify that adequate space is available for entry and installation of the item of equipment, including associated piping and accessories. Also verify that adequate space is available for servicing of the equipment.
- D. If extensive changes in pipe, duct or equipment layout or electrical wiring and equipment are brought about by the use of equipment which is not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in the contract.

1.15 SHOP DRAWINGS

- A. Refer to Section 01600 Product Requirements.

- B. Shop drawings for equipment fixtures, devices and materials shall be labeled and identified same as on the Contract Documents. Failure to do so may be cause for rejection of shop drawings.
- C. The review of shop drawings by the Architect or Engineer shall not relieve the Contactor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.
- D. Shop drawings for the following Fire Suppression equipment and materials shall be submitted
 - 1. Pipe, fittings and joining methods for the various systems.
 - 2. Firestopping systems for pipe penetrations.
 - 3. Pipe hangers.
 - 4. Valves.
 - 5. Gauges.
 - 6. Sprinkler heads and accessories.
 - 7. Wet pipe and dry pipe components.
 - 8. Sprinkler system installation drawings per NFPA 13, applicable calculations and water supply flow curve.

1.16 FINAL INSPECTION AND PUNCH LIST

- A. Refer to Section 017700 Closeout Procedures.

1.17 OPERATING AND MAINTENANCE MANUALS

- A. Refer to Section 017823 Operation and Maintenance Data.
- B. All shop drawing and installation, maintenance and operating instruction pamphlets or brochures, wiring diagrams, parts list and other information, along with warranties, shall be obtained from each manufacturer of the principal items of equipment. In addition, the Contractor shall prepare a chart listing all items of equipment which are furnished under his contract and indicating the nature of maintenance required, the recommended frequency of checking these points and the type of lubricating media or replacement material required.
- C. These shall be assembled into three-ring loose lead binders or other appropriate binding and also combined into a single electronic file in .PDF format. An index and tabbed sheets to separate the sections shall be included. These shall be submitted to the Architect or Engineer for review. Upon approval, manuals shall be turned over to the Owner.

1.18 RECORD DRAWINGS

- A. Refer to Section 017839 Project Record Drawings.
- B. Each Contractor shall maintain a separate set of prints of the contract documents and shall show all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work, these drawing shall be turned over to the Architect.

1.19 WARRANTIES

- A. Refer to Section 017700 Closeout Procedures.
- B. This Contractor shall warrant all workmanship, equipment and material entering into this contract for a period of one year of date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect. Any materials or equipment proving to be defective during this warranty period shall be made good by this Contractor without expense to the Owner.
- C. This provision is intended specifically to cover deficiencies in contract completion or performance which are discovered after systems are placed in operation. Also included shall be supplementary assistance in balancing, adjusting or providing operating instructions as the need develops, and replacing overload heater elements in starters where necessary to keep systems in operation. Heater element sizes shall not exceed the motor manufacturer's recommendations.
- D. This provision shall not be construed to include maintenance items such as replacing filters, re-tightening or repacking glands, greasing, oiling belt tightening and cleaning strainers after these have been done for final close-out.
- E. Provisions of this warranty shall be considered supplementary to warranty provisions under General Conditions.

1.20 PROJECT CLOSEOUT

- A. Refer to Section 017700 Closeout Procedures.

1.21 OPERATIONS AND ADJUSTMENT OF EQUIPMENT

- A. As the fire suppression systems are placed in operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing air and water systems, adjusting fan speeds, belts, pulleys, tightening packing glands, and adjusting all operating equipment.
- B. Caution: Verify that all bearings are lubricated, all motors are operating in the right direction, and correct overload heater elements are provided on all motors. Do not depend wholly on the electrician's judgment in these matters. Follow specific instructions in regard to lubrication. Do not oil or grease presealed ball bearings unless upon manufacturer's specific instructions.
- C. Test relief valves, air vents and regulating valves to insure proper operation.

1.22 OPERATING DEMONSTRATION AND INSTRUCTIONS

- A. Refer to Section 017900 Demonstration and Training as well as individual Division 21 Sections for requirements.
- B. The Contractor shall set the various systems into operation and demonstrate to the Owner and Architect that the systems function properly and that the requirements of the Contract are fulfilled.

- C. The Contractor shall provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.
- D. A minimum of 2 hours shall be allowed for instructions to personnel selected by the Owner. Instructions shall include not less than the following:
 - 1. Show locations of items of equipment and their purpose.
 - 2. Review binder containing instructions and equipment and systems data.
 - 3. Coordinate written and verbal instructions so that personnel understand each.

1.23 BUILD AMERICA, BUY AMERICA ACT REQUIREMENTS

- A. This project will receive Federal funding. Therefore, product and materials procured for the project must comply with the Build America, Buy America Act (BABA). Refer to the City of Dayton General Provisions and Supplemental Specification for compliance requirements.
- B. The Contractor must maintain a complete list of construction material, product, and manufacturers' certifications for product used in the project in order to verify (BABA) compliance.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION – NOT APPLICABLE

END OF SECTION 21 0001

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SECTION 21 0002 – FIRE SUPPRESSION WORK IN EXISTING BUILDINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes the following:

1. General Requirements for Renovation Work
2. Inspection of Existing Building
3. Asbestos Material
4. Work Hours
5. Tobacco Products
6. Barriers and Signage
7. Storage of Tools and Materials
8. Protection of Existing Building and Equipment
9. Confined Spaces
10. Noise, Fumes and Dust Control
11. Soldering Welding and Cutting
12. Removals Disposal and Reuse
13. Draining, Flush and Refill of Piping Systems
14. Continuity of Systems
15. Cutting and Patching
16. Cleaning

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 GENERAL REQUIREMENTS FOR RENOVATION WORK

- A. Refer to Article 1 Specification requirements and notes on the drawings where provided for requirements related to renovation work.

- B. Meet with the Owner, Architect and Engineer before demolition or construction begins to establish procedures for work effort in the existing building. Provide names and phone numbers and establish emergency contact information where work is performed. Provide security information to the Owner for all personnel who will be working on site. Educate all construction personnel in regard to the project requirements and procedures.
- C. Coordinate effort with other contractors involved in the renovation project to minimize the disruption, system outages, phasing of work, share cleaning responsibilities, etc.

1.4 INSPECTION OF EXISTING BUILDING

- A. Each bidder shall inspect the project site and the existing building in the early time frame of the bidding period. Conditions shall be compared with information shown on the drawings. Report to the Architect/Engineer any significant discrepancies which may be discovered in a timely fashion so that direction may be provided in an addendum. After the contract is signed, no allowance will be made for failure to have made a thorough inspection.

1.5 ASBESTOS MATERIAL

- A. Abatement, removal or encapsulation of existing materials containing asbestos is not included in the Contract. Necessary work of this nature will be arranged by the Owner to be done outside of this construction and remodeling project by a company regularly engaged in asbestos abatement. Such work will be scheduled and performed in advance of work in the construction and remodeling project.
- B. If, in the performance of the fire suppression work, materials are observed which are suspected to contain asbestos, the Contractor shall immediately inform the Architect who in turn will notify the Owner. Work that would expose workers to the inhalation of asbestos particles shall be terminated. Work may be resumed only after a determination has been made and unsafe materials have been removed or encapsulated and the area declared safe.

1.6 WORK HOURS

- A. Work hours for construction shall be as defined in Section 01150- Project Phasing or other specification sections or drawing notes.
- B. Where allowed, contractors may work normal hours except after hours is required for operations that are noisy, generate obnoxious fumes or dust, require shut down of ventilation systems, etc. The Owner reserves the right to stop normal hour work where the Owner deems the effort to be disruptive to their ongoing operations.
- C. Any work that creates hazards in or requires closure of corridors, exit pathways or stairwells work in corridors must be performed after hours when the building is not occupied.
- D. All occupied areas, corridors exit pathways and stairwells must be left clean, lighted (including emergency egress and exit signage) usable and safe at the end of each work shift.

- E. Access to the work area shall be coordinated with the Owner; follow all security protocols for parking, sign in, key control, etc. established by the Owner.

1.7 TOBACCO PRODUCTS

- A. Smoking or chewing tobacco products are expressly prohibited to be used within the building and on the premises except where specifically permitted by the Owner or in construction company trailers or vehicles where permitted by the construction company.

PART 2 - PRODUCTS- NOT APPLICABLE

PART 3 - EXECUTION

3.1 BARRIERS AND SIGNAGE

- A. Barriers and signage shall be provided as appropriate to identify work areas and to prevent unauthorized entry by non construction personnel. Refer to appropriate Division 1 specification requirements and notes on the drawings where provided.
- B. All barriers and signs should be high visibility type and be maintained at all times.

3.2 STORAGE OF TOOLS AND MATERIALS

- A. Store all site material and tools in the active job site area, specific storage areas are not provided except where otherwise noted for material and tools. The contractor is responsible for security.
- B. Storage is specifically prohibited in means of egress paths and stairwells.

3.3 PROTECTION OF EXISTING BUILDING AND EQUIPMENT

- A. The Owners' property and the property of other contractors shall be respected at all times. Provide drop clothes, visqueen or other suitable barriers where dust and debris is generated. Tape ends of barriers for sealing purposes.
- B. Provide 55 gallon drums or smaller buckets as appropriate and use funnels, hoses, etc. where draining liquid systems.
- C. Provide plywood sheets for protection of walls, floors or Owner equipment or systems that are remaining in place near demolition or new installation work where there is possible damage from heavy material or equipment.

3.4 CONFINED SPACES

- A. Notify the Owner when performing work in confined spaces. Provide a written procedure for approval and obtain approval from the Owner when so requested.
- B. All work in confined spaces shall be done in accordance with OSHA regulations.

3.5 NOISE FUME AND DUST CONTROL

- A. Provide barriers and ventilation as required to limit the effect from construction generated noise fume and dust control on spaces that continue to be occupied by the Owner. Refer to protection of building and equipment paragraph above. In addition to the basic protection, provide additional visqueen barriers to limit airborne migration of dust and fumes. Provide supplemental portable fans to exhaust air to the outside of the building where appropriate. Use of the Owners' ventilation systems to induce positive or negative pressure is prohibited unless authorized by the Owner. Shut off ventilation systems serving the area where use of these systems can induce fumes or dust into return or exhaust ducts. Where systems need to remain operational for occupied areas, arrange to temporarily shutoff portions of the system in the work area. Provide taped visqueen covers on HVAC air supply and exhaust devices to limit migration. Coordinate all efforts requiring modification or shutdown of ventilation systems with the Owner. Contractor shut down of these systems is prohibited without Owner permission.
- B. Arrange with the Owner when required to shutoff fire alarm or smoke detectors to perform work. With the Owners' prior approval. Cover smoke detectors where needed to prevent false alarms due to generated dust or fumes. Minimize outages and coordinate efforts to limit the effect due to false alarms.
- C. Where significant dust or fume generating work, welding or cutting operations are required for removal or new work, provide fume removal equipment with telescoping arms to locally capture the fumes. Fume exhaust shall be directed outside or adequately filtered and recirculated.
- D. Areas shall be thoroughly ventilated after completion of the work on a daily basis to remove residual odors and fumes before occupancy occurs the next day.
- E. Provide vacuum cleaners and other equipment to clean and restore conditions.

3.6 SOLDERING WELDING AND CUTTING

- A. For soldering, welding or cutting operations, provide insulated, fire rated barriers and blankets to isolate cover and protect remaining systems and materials, furniture, furnishings, floors, walls, ceilings, etc.
- B. Refer to noise, fume and dust control provisions in the previous paragraph.
- C. Obtain burn approval from the Owner before commencing any soldering or welding effort. Coordinate outages of fire alarm systems as noted in the previous paragraph.

- D. Provide a Fire Watch at each welding location. Fire Watch personnel shall be dedicated for the sole purpose of fire prevention during welding operations. All Fire Watch personnel shall be properly trained and equipped, including fire extinguisher, fire blanket and communication equipment for assistance request.
- E. Provide a fire extinguisher at every soldering or welding location.

3.7 REMOVALS DISPOSAL AND REUSE

- A. Refer to the drawings for the scope of remodeling in the existing building.
- B. Cooperate with the General Contractor regarding all removal and remodeling work. Each Contractor shall remove existing work which is associated with his trade and which will be superfluous when the new work is installed and made operational.
- C. Extraneous piping which is or becomes accessible shall be removed and stubs shall be capped at the first active duct or pipe encountered. Piping that is and remains inaccessible shall be abandoned. Ends of abandoned pipe shall be capped so as to be concealed by finished surfaces. Upon completion of the work no abandoned duct. Pipe, valve or stub shall extend thru finished floors, walls or ceilings.
- D. When it is necessary to reroute a section of active ductwork or piping the rerouted section shall be installed before removing the existing in order to minimize system down time. Rerouted sections shall be insulated as required for new work. Patch insulation on existing ductwork and piping which has been damaged or removed in this work.
- E. Where existing piping is removed and holes are left in existing walls, finished ceilings, floors, etc., these holes shall be patched using materials to match the existing construction to restore and maintain the integrity of the existing partition.
- F. Materials and equipment which are removed shall not be reused within the scope of this project unless specifically noted to be relocated or reused. Turn over to the Owner and place where directed on the premises all removed material and equipment so designated by the Owner. All material and equipment which the Owner does not wish to retain shall become the property of the Contractor responsible for removal and shall be removed from the premises and properly disposed.
- G. Disposal of materials regulated by EPA shall be done in strict accordance with latest requirements. Provide documentation to the Owner that disposal was properly executed.
- H. Remove, store and reinstall lay-in ceiling tile and grid as needed to perform work in areas where such removal and re-installation is not to be done by the General Contractor. Damaged tile and/or grid shall be replaced with new matching tile and/or grid.
- I. In areas of minor work where the space is not completely vacated, temporarily move portable equipment and furnishings within the space as required to complete the work. Coordinate this activity with Owner. Protect the Owner's property by providing dust covers and temporary

plastic film barriers to contain dust. Remove barriers and return equipment and furniture upon completion of the work.

- J. Refinish any surface disturbed under this work match existing, except where refinishing of that surface is included under the General Contract.

3.8 DRAINING FLUSHING AND REFILL OF PIPING SYSTEMS

- A. Existing liquid systems shall be drained as required before removal or connection of new piping extensions.
- B. Draining of the system shall be the responsibility of the contractor. Provide threaded connections, etc. to direct fluids to drainage points. Water systems may be drained to sanitary systems or where permitted, to storm systems. Verify any chemical treatment, inhibitors or freeze protection additives in the existing systems and obtain a permit from the local sewer authority before disposing.
- C. Provide drums or containers to accept other than water drainage and remove from the premises and properly dispose. Provide visqueen to protect Owners' property when opening pipes, even where piping has been drained to prevent damage from residual liquid that remains in the pipe.

3.9 CONTINUITY OF SYSTEMS

- A. Work shall be so planned and executed as to provide reasonably continuous services of existing systems throughout the construction period. Where necessary to disrupt services for short periods of time for connection, alteration or switch-over, the Owner shall be notified in advance and outages scheduled at the Owner's reasonable convenience.
- B. Submit, on request, a written step-by-step sequence of operations proposed to accomplish the work. The outline must include tentative dates, times of day for disruption, downtime and restoration services. Submit the outline sufficiently in advance of the proposed work to allow the Architect or Engineer to review the information with the Owner. Upon approval, final planning and the work shall be done in close coordination with the Owner.
- C. Shutdown of system and work undertaken during shutdowns shall be bid as being done during normal working hours. If the Owner should require such work be performed outside of normal working hours, reimbursement shall be made for premium time expenses only.

3.10 CUTTING AND PATCHING

- A. Refer to Division 1 – General Requirements for information regarding cutting and patching.
- B. Plan the work well ahead of the general construction. Where pipes and ducts are to pass thru new walls, partitions, floors, roof or ceilings, place sleeves in these elements or arrange with the General Contractor to provide openings where sleeves are not practical. Where sleeves or openings have not been installed, cut holes and patch as required for the installation of this

work, or pay other trades for doing this work when so directed by the Architect. Any damage caused to the building shall be repaired or rectified.

- C. Where pipes and ducts are to pass thru, above or behind existing walls, partitions, floors, roof or ceiling, cutting, patching and refinishing of same shall be included in this contract. Core drilling and saw cutting shall be utilized.
- D. All material, methods and procedures used in patching and refinishing shall be in accordance with applicable provisions of specifications governing the various trades. The final appearance and integrity of the patched and refinished areas must meet the approval of the Architect. Wall, floor and ceiling refinishing must extend to logical termination lines (entire ceiling of the room repainted, for instance), if an acceptable appearance cannot be attained by finishing a partial area.
- E. Provide steel angle or channel lintels to span openings which are cut in existing jointed masonry wall where the opening span exceeds 16 inches. Provide framing around roof openings for required support of the roof deck.

3.11 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.
- C. Cleaning responsibility remains with the contractor creating the dust or debris unless noted otherwise in Division 1 specifications. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain.
- D. The contractor shall also clean duct interiors and interior components of new or existing air handling system equipment if dirt, dust or debris have generated in the course of work have accumulated on these surfaces.

END OF SECTION 21 0002

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SECTION 21 0004 – FIRESTOPPING FOR FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Firestopping assemblies shall be tested and rated in accordance with ASTM E814 (ANSI/UL 1479) Fire Tests of Through-Penetration Fire Stops (minimum positive pressure of .01 inches of water column) and E119 (ANSI/UL 263) Fire Tests of Building Construction and Materials Time-Temperature Curve. Firestopping shall provide an “F” fire rating equal to that of the construction being penetrated. Firestop systems shall meet all requirements of the Ohio Building Code.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view or above ceilings in air return plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Firestopping materials shall be manufactured and/or supplied by:

1. Hilti, Inc.
2. Johns Manville.
3. Nelson Firestop Products.
4. Specified Technologies Inc.
5. 3M; Fire Protection Products Division.
6. Tremco; Sealant/Weatherproofing Division.

2.2 FIRESTOPPING

A. Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. These shall be installed in conjunction with sleeves and materials for fill and damming.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.
- B. Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.
- C. Provide firestop system for every pipe at penetration of all fire resistance rated walls and horizontal assemblies.
- D. Provide rigid supports for pipes on both sides of the fire resistance rated wall or assembly where required as part of the fire stop assembly.
- E. Coordinate opening size and additional framing requirements with the General Contractor for each opening to meet the firestop installation requirements.
- F. Annular space of penetrations of non-fire-resistant-rated floor, floor/ceiling assemblies, or the ceiling membrane of a non-fire-resistant rated roof/ceiling assembly shall be filled with an approved firestopping material to resist the free passage of flame and products of combustion.
- G. Smoke Barriers:
1. Penetrations shall be sealed with a firestopping system to prevent the passage of smoke.

H. Smoke Partitions:

1. Penetrations shall be sealed with a caulking material to prevent the passage of smoke.
Non-rated smoke partitions do not require a fire stopping system.

END OF SECTION 21 0004

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SECTION 21 0513 - ELECTRICAL REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for electrical work for Fire Suppression equipment including single-phase and polyphase, 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 and other electrical equipment, devices, fuses, wire, conduit and installation methods.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

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.
- B. Refer to the Fire Suppression drawings and also the Electrical drawings for requirements related to each trade. Coordinate all aspects of electrical components and wiring to complete the systems.

1.4 QUALITY ASSURANCE

- A. Equipment, devices shall be designed, constructed and installed in accordance with applicable standards of NEMA and the National Electric Code. Equipment shall be tested and listed by UL or other approved agency and installed in accordance with all instructions included as part of such listing.
- B. Electrical equipment, devices, fuses, wire, conduit and methods shall comply with applicable provisions of Division 26 - Electrical.

PART 2 - PRODUCTS

2.1 Motors

- A. General duty motors shall be induction type 1750 rpm NEMA Design "B" with copper windings, Class B or F insulation, and motor enclosure to suit the application. Service factor shall be 1.15 minimum.
- B. Two-speed motors shall be two-winding type with six leads unless otherwise specified.
- C. Motors for other than general duty application shall be furnished to suit the application and operating environment.
- D. Premium efficiency motors shall be equal to Century "E + 3", General Electric "Energy Saver Premium Efficiency", Baldor "Super E Premium Efficient" or Reliance "Premium Energy Efficient" series. Motor efficiencies shall be tested and conform to NEMA Standard Publication MG-1 and IEEE 112 Test Method B.
- E. Motor sizes shown on the drawings are to be considered minimum. Motors furnished shall be sized so as to not operate in the service factor range. Motors for direct driven pumps and fans shall be selected so as to not operate in the service factor range at any point on the curve.
- F. The Fire Suppression Contractor and equipment suppliers shall compare the electrical power requirements of the intended equipment with power feeders to the equipment shown on the Electrical drawings. Verify adequacy and compatibility of voltage, phase, wiring, capacity, number and size of conductors (versus equipment connection points), fusing and other information on the electrical and mechanical drawings to that required for the equipment. If the selected equipment requires revision of the electrical, added cost must be borne by the Fire Suppression Contractor.

2.2 STARTERS

- A. Magnetic starters shall comply with provisions of Division 26 - Electrical Specifications and shall be NEMA construction (IEC rated not acceptable) with thermal overload element on each phase, 115 volt control voltage and hand-off-automatic switch, where appropriate. An integral control transformer shall be incorporated in the starter for each motor of 200 volt and greater. A single control transformer is acceptable for multiple motor packaged equipment, however, when such is the manufacturer's standard. Duplex type units (pumps, compressors, etc.) are not included in this exception. A control transformer shall be provided in each starter to insure standby operating capability.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Motor connections of factory assembled equipment shall be made with flexible conduit except for plug-in electric cord connections.

- B. All power wiring shall be run in conduit. Control wiring shall be run in conduit except where open wiring is permitted in other applicable specification sections.
- C. Fuses shall be furnished and installed in fuse clips of equipment and switches provided by the Fire Suppression Contractors.

END OF SECTION 21 0513

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SECTION 21 0519 - METERS AND GAUGES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gauges.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

- A. Pressure gauges, including compound gauges and vacuum gauges, shall be Bourdon tube type with 4-1/2" dial and cast aluminum case, equal to Trerice 600C Series. Accuracy shall be 1% at mid-range.
- B. Pressure gauges for low pressure application, calibrated in inches of water gauge, ounces per sq. in. or 0-5 psi, as appropriate, shall be equal to Trerice 860.
- C. Pressure gauges at pumps shall be liquid filled Bourdon tube type with 4" dial and stainless steel case and internals, equal to Trerice 700 Series.
- D. A brass cock or bronze ball valve and a pressure snubber shall be furnished with each pressure gauge.
- E. Ranges of pressure gauges shall be selected to be consistent with anticipated pressures. Range shall be approximately twice the normal system working pressure at the gauge location.

2.2 TEST PLUGS

- A. Pressure-temperature test plugs for insertion of pressure gauge or thermometer shall be a brass fitting with neoprene or Nordel self-sealing insert and knurled brass cap with plastic capture tab. Fittings shall be equal to Peterson "PT". Furnish two thermometers and two pressure gauges with integral insertion stem appropriate for use with the test plugs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Pressure gauges shall be installed where shown on the drawings, where required by applicable codes and also at:
- B. Gauges shall be positioned to be read with an unobstructed view from the floor. Pressure-temperature test plugs shall be installed where shown, located in a position to be most readable.

END OF SECTION 21 0519

SECTION 21 0529 – PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Hanger Rods and Attachments.
 - 4. Pipe Riser Supports
 - 5. Base Mounted Pipe Supports

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS

- A. Hangers and supports for piping shall be equal to the Anvil catalog numbers as follows:
 - 1. Pear shaped band hanger with adjustable swivel ring type per NFPA standards, lock nut and rod attachment, carbon steel with galvanized finish, Anvil fig. 69.

2.2 HANGER RODS AND ATTACHMENTS

- A. Hanger rods shall be solid steel, threaded end or all-thread rod, of diameter listed below. A hanger attachment device (for attachment to the structure) and locking nut at the hanger attachment shall be provided on each hanger.

Pipe SizeMin. Rod Dia.

4" and smaller	3/8"
5" to 6"	1/2"
8"	5/8"

- B. Hanger rod attachment devices for attachment to the structure shall be:

1. Beam clamps for steel construction equal to Anvil Fig. 92, 93, or 94. Utilize swivel type in sloped steel construction to provide vertical support of pipe without bending hanger rods.
2. Channel support system equal to Unistrut or Hilti.

2.3 PIPE RISER SUPPORTS

- A. Riser clamps shall be:

1. Carbon steel, epoxy coated or galvanized finish- Anvil Fig. 261.

2.4 BASE MOUNTED PIPE SUPPORTS

- A. Base mounted pipe supports shall be factory or shop prime coat painted equal to Anvil Fig. numbers as follows:

1. Adjustable pipe saddle support and yoke- Fig. 265.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Spacing of hangers shall be as follows:

1. Steel pipe - Vertical:
 - a. At the base and 15 ft. maximum spacing unless otherwise shown.
2. Steel pipe - Horizontal:
 - a. 2" size and smaller – 8 ft. intervals
 - b. 2-1/2" thru 6" – 10 ft. intervals
 - c. 8" and larger – 12 ft. intervals.
3. Copper Tubing - Vertical
 - a. At the base and 10 ft. maximum spacing unless otherwise shown.

4. Copper Tubing – Horizontal
 - a. 1-1/4" size and smaller – 6 ft. intervals
 - b. 1-1/2" thru 2" – 8 ft. intervals
 - c. 2-1/2" and larger – 10 ft. intervals
- B. In piping systems with rolled or cut groove end pipe and mechanical joint couplings, pipe hangers shall be provided on horizontal piping at normal specified intervals and, in addition, so that no pipe shall be left unsupported between any two couplings nor left unsupported whenever a change in direction takes place. Added supports may be omitted on "rigid" couplings such as Victaulic Style 07 Zero-Flex. Vertical piping shall be supported at normal specified intervals or every other pipe length, whichever is more frequent. The base of the riser or base fitting shall be supported.
- C. Attachment of pipe hangers to the structure shall be with:
 1. Provide anchoring where steel beam clamps are attached to sloping surfaces of beam flanges and where otherwise required to insure permanent attachment.
 2. Attachment to steel deck is prohibited. Span from steel structural members with supplementary steel shapes where direct attachment to structural members is not practical.
- D. Attachment to manufactured trusses and other engineered structural members and supports shall be done in strict accordance with the structural manufacturer's recommendations. Refer to the architectural and structural drawings for types of engineered structural systems being used. Connections to these structural members shall be made with connection devices and methods approved by the structural manufacturer. Provide additional supports with supplemental steel shapes when spacing between structural members exceeds specified distances.
- E. Pipe hangers shall be adjusted to proper elevation and all hanger rods set in a vertical position.
- F. Extended legs of pipe riser clamps shall be shortened as needed to maintain concealment of the clamp within finished spaces. Ensure that adequate support is still maintained.

END OF SECTION 21 0529

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SECTION 21 0530- EQUIPMENT BASES AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Equipment Supports

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

- A. Product Data: For the following:

1. Equipment hangers and supports.
2. Equipment bases.
3. Support Curbs.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 CONCRETE BASES

- A. Concrete bases and pads with anchor bolts cast-in-place. Bases shall be formed on all sides and hand troweled to a smooth, dense finish with neatly chamfered corners. Large concrete pads on grade shall be constructed with reinforcing steel or reinforcing roadway mesh.

2.2 STEEL SUPPORTS

- A. Structural steel angles, beams or channels, unistrut type channels or pipe. Supports shall be fabricated into a rigid framework with welded or bolted connections and cross-bracing or sway bracing. Supports shall be set on slab with base plates, or attached to the building structure as required. Brackets for relatively lightweight equipment may be attached to the wall. Equipment shall be set on and attached to the framework.
- B. Solid steel hanger rods supported from the structure above similar to pipe hangers. Provide sway bracing for equipment supported in this manner.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Concrete bases for plumbing equipment are included in the Fire Suppression Contract. The Fire Suppression Contractor shall provide exact dimensions, locations and other details for the specific equipment provided. The Fire Suppression Contractor shall set anchor bolts as required for the equipment.

END OF SECTION 21 0530

SECTION 21 0553 - IDENTIFICATION FOR FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Valve Tags
4. Duct labels.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTAL

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Labels, tags and markers shall comply with ANSI A13.1 for lettering size, colors and length of color field.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Each item or major equipment shall be labeled.
- B. Labeling shall be:
1. Permanently attached plastic laminated signs with 1" high lettering.

2.2 PIPE LABELS

- A. Pipe markings shall be applied to all piping.
- B. Labeling shall be:

1. Plastic semi-rigid snap-on type, manufacturer's standard pre-printed color coded pipe markers extending fully around the pipe and insulation or pressure-sensitive vinyl pipe markers similar to above.

2.3 VALVE TAGS

- A. Each shutoff valve, other than at equipment, shall be identified with a stamped tag. Valves and tagging shall be scheduled, typewritten on 8-1/2" x 11" paper, tabulating valve number, piping system, abbreviation, location of valve (room or area) and service (e.g. – south wing reheat boxes).
- B. Valve tags shall be engraved plastic laminate with solid brass S hook. Tags shall be engraved with "F" for Fire Suppression and the designated number.

2.4 ACCEPTABLE MANUFACTURERS

- A. Labels, markings and tags shall be manufactured by W.H. Brady, Seton, Allen or Industrial Safety Supply.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification marking and tagging shall be applied after painting has been completed.
- B. Coordinate names, abbreviations and other designations used with corresponding designations shown, specified or scheduled on drawings. Verify with Owners' desired identification marking system.
- C. The Plumbing, Fire Suppression and HVAC Contractors shall coordinate labeling, marking and tagging to attain coordinated and consistent systems of identification.
- D. Equipment labeling shall consist of unit designation as shown on the drawings.
- E. Pipe markers shall be placed at 25 ft. centers in mechanical rooms and concealed spaces and at 50 ft. centers in other exposed locations.
- F. Refer to appropriate sections of this specification for installation of underground line marker tape.
- G. Valve tags shall be placed on each valve except those intended for isolation of individual items of equipment. Valve tag schedules shall be prepared as specified above.

END OF SECTION 21 0553

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 RELATED SECTIONS

1. Division 21 Section "Dry-Pipe Sprinkler Systems" for dry-pipe sprinkler piping.
2. Division 21 Section "Electric-Drive, Vertical-Turbine Fire Pumps" for fire pumps, pressure-maintenance pumps, and fire-pump controllers.

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 devices.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Design sprinkler system(s), by a State certified designer, using performance requirements and design criteria indicated.
1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
- C. System shall conform to the requirements of NFPA 13 and OBC chapter 9 and other requirements of the authority having jurisdiction.

- D. Sprinkler system design shall be approved by authorities having jurisdiction.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Approved Sprinkler Piping Drawings and Calculations: Working plans and hydraulic calculations, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- C. Welding certificates.
- D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- E. Field quality-control reports.
- F. Operation and maintenance data.

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. Design Responsibility: Preparation of working plans, calculations, and field test reports by a certified sprinkler designer.
- B. 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.
- D. 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."

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to piping schedule on the Drawings for piping material and applications.

2.2 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed, or FM approved.
2. Minimum Pressure Rating: 175 psig.
3. Acceptable Manufacturers: Subject to compliance with requirements:
 - a. Anvil International, Inc.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Stockholm Valve and Fittings.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
 - f. Watts Water Technologies, Inc.

B. Check Valves 2 1/2" and larger:

1. Standard: UL 312.
2. Type: Swing check.
3. Body Material: Cast iron.
4. Disc Material: Bronze
5. End Connections: Flanged or grooved.

C. Check Valves 2" and smaller:

1. Standard: UL 312.
2. Type: Swing check.
3. Body Material: Bronze.
4. Disc Material: Composition faced
5. End Connections: Threaded.

D. OS&Y Gate Valves 2" and smaller:

1. Standard: UL 262.
2. Body Material: Bronze.
3. End Connections: Threaded.

E. OS&Y Gate Valves: 2 1/2" and larger

1. Standard: UL 262.
2. Body Material: Cast or ductile iron.
3. End Connections: Flanged or grooved.

F. Indicating-Type Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig minimum.
3. Valves 2" and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.

- c. End Connections: Threaded.
 - 4. Valves 2-1/2" and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.
 - 5. Valve Operation: Integral electrical, pre-wired, single-circuit, supervisory switch indicating device.
- G. Trim and Drain Ball Valves:
- 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 2. Body Material: Bronze.
 - 3. End Connections: Threaded.

2.3 SPECIALTY VALVES

A. General Requirements:

- 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
- 2. Minimum Pressure Rating: 175 psig.
- 3. Body Material: Cast or ductile iron.
- 4. Size: Same as connected piping.
- 5. End Connections: Flanged or grooved.
- 6. Acceptable manufacturers:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 - e. Viking Corporation.

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.

C. Automatic (Ball Drip) Drain Valves:

- 1. Standard: UL 1726.
- 2. Pressure Rating: 175 psig minimum.
- 3. Type: Automatic draining, ball check.
- 4. Size: 3/4".
- 5. End Connections: Threaded.

2.4 FIRE-DEPARTMENT CONNECTIONS

- A. Fire department connection is existing.

2.5 SPRINKLER SPECIALTY PIPE FITTINGS

- A. 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.
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.
6. Acceptable Manufacturers
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.

- B. Branch Line Testers:

1. Standard: UL 199.
2. Pressure Rating: 175 psig minimum.
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.
8. Acceptable Manufacturers:
 - a. Elkhart Brass Mfg. Company, Inc.
 - b. Fire-End & Croker Corporation.
 - c. Potter Roemer.

- C. 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.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.
6. Acceptable Manufacturers:
 - a. Tyco Fire & Building Products LP.
 - b. Victaulic Company.
 - c. Viking Corporation.

2.6 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 minimum.
3. Acceptable Manufacturers:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 - e. Viking Corporation.

B. Automatic Sprinklers:

1. Non-residential Applications: UL 199.
2. Characteristics: Quick-response type with nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

C. Sprinkler Finishes:

1. Rough brass.
2. Chrome plated.
3. Painted.

D. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications.

1. Exposed Pendent Sprinklers: White-coated steel, one piece, flat.
2. Concealed Recessed Sprinklers: Flat, White-coated steel, two piece, with 1-inch vertical adjustment and a flat cover plate.
3. Sidewall Mounting: White -coated steel one piece, flat.

E. Spare sprinklers. Furnish spare sprinklers and sprinkler wrench in accordance with the requirements of NFPA 25. spare sprinklers shall include each type and temperature rating in a proportional amount equal of those installed. Provide a wall mounted cabinet for sprinklers and wrench.

2.7 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. 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. Pressure Rating: 250 psig.
6. Design Installation: Horizontal or vertical.
7. Manufacturers:
 - a. ADT Security Services, Inc.
 - b. McDonnell & Miller; ITT Industries.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.
 - e. Viking Corporation.
 - f. Victaulic Company.

C. 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.
5. Manufacturers:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.

2.8 PIPE ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated finish with setscrews.
- C. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.9 SLEEVES

- A. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.

PART 3 - EXECUTION

3.1 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Division 21 Section "Facility Water-Service."
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

3.2 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. Locate sprinkler piping in areas protected from freezing.
- C. Piping Standard: Comply with requirements for installation of sprinkler piping 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 2" and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having 2-1/2" 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 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.
- J. Install alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- L. 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 1/4" 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.

- M. Install escutcheons for penetrations of walls, ceilings, and floors.
- N. Fill sprinkler system piping with water.

3.3 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. Ream ends of pipes and tubes and remove burs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- D. 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.
- E. 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 burs 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.
- F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - 1. Shop weld pipe joints where welded piping is indicated.
- G. Steel-Piping, Cut-Grooved Joints: Cut square-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 joints.
- 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.

3.4 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 backflow preventer 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.

3.5 SPRINKLER INSTALLATION

- A. Refer to the drawing for the locations of various types of sprinklers.
- B. Install sprinklers in suspended ceilings in center of acoustic ceiling panels or at the quarter points along the long axis for rectangular panels.
- C. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

3.6 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, and walls.
- B. Sleeves are not required for core-drilled holes in cast walls or floors.
- C. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- D. Install sleeves in new partitions, slabs, and walls as they are built.
- E. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- F. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- G. Seal space outside of sleeves in concrete slabs and walls with grout.
- H. 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 firestop materials and installations in Division 07 Section "Penetration Firestopping."

3.7 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 Division 26 Section "Identification for Electrical Systems."

3.8 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. Coordinate with fire-alarm tests. Operate as required.
 - 5. 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.
- E. Turn spare sprinklers, wrench and cabinet over to owner

3.9 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

3.10 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded or grooved cast-iron fittings; and joints.
 - 1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 - 2. Upright, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 211313

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SECTION 211316 - DRY-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Sprinkler specialty pipe fittings.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 SYSTEM DESCRIPTIONS

- A. Dry-Pipe Sprinkler System: Automatic sprinklers with dry flexible hoses are attached to piping containing compressed air. The opening of sprinkler(s) releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from sprinklers that are open.

1.4 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig 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.
- C. Sprinkler system design shall be approved by authorities having jurisdiction.
1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 2. Sprinkler Occupancy Hazard Classifications:

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Approved Sprinkler Piping Drawings and Calculations: Working plans and hydraulic calculations, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- C. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- D. Field quality-control reports.
- E. Operation and maintenance data.

1.6 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. Design 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."

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to piping schedule on the Drawings for piping material and applications.

2.2 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
 - 1. Valves shall be UL listed, or FM approved.
 - 2. Minimum Pressure Rating: 175 psig.
 - 3. Acceptable Manufacturers: Subject to compliance with requirements:
 - a. Anvil International, Inc.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Stockholm Valve and Fittings.

- d. Tyco Fire & Building Products LP.
- e. Victaulic Company.
- f. Watts Water Technologies, Inc.

B. Check Valves 2 1/2" and larger:

- 1. Standard: UL 312.
- 2. Type: Swing check.
- 3. Body Material: Cast iron.
- 4. Disc Material: Bronze
- 5. End Connections: Flanged or grooved.

C. Check Valves 2" and smaller:

- 1. Standard: UL 312.
- 2. Type: Swing check.
- 3. Body Material: Bronze.
- 4. Disc Material: Composition faced
- 5. End Connections: Threaded.

D. OS&Y Gate Valves 2" and smaller:

- 1. Standard: UL 262.
- 2. Body Material: Bronze.
- 3. End Connections: Threaded.

E. OS&Y Gate Valves: 2 1/2" and larger

- 1. Standard: UL 262.
- 2. Body Material: Cast or ductile iron.
- 3. End Connections: Flanged or grooved.

F. Indicating-Type Butterfly Valves:

- 1. Standard: UL 1091.
- 2. Pressure Rating: 175 psig minimum.
- 3. Valves 2" and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.
 - c. End Connections: Threaded.
- 4. Valves 2-1/2" and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.
- 5. Valve Operation: Integral electrical, prewired, single-circuit, supervisory switch] indicating device.

G. Trim and Drain Ball Valves:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Body Material: Bronze.
3. End Connections: Threaded.

2.3 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Dry-Pipe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 - e. Viking Corporation.
2. Standard: UL 260
3. Design: Differential-pressure type.
4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
5. Air Compressor:
 - 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) Gast Manufacturing Inc.
 - 2) General Air Products, Inc,
 - 3) Viking Corporation.
 - b. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - c. Motor Horsepower: Fractional.
 - d. Power: 120-V ac, 60 Hz, single phase.

2.4 SPRINKLER SPECIALTY PIPE FITTINGS

A. 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 .
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.
6. Acceptable Manufacturers
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.

B. Branch Line Testers:

1. Standard: UL 199.
2. Pressure Rating: 175 psig minimum.
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.
8. Acceptable Manufacturers:
 - a. Elkhart Brass Mfg. Company, Inc.
 - b. Fire-End & Croker Corporation.
 - c. Potter Roemer.

C. 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.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.
6. Acceptable Manufacturers:
 - a. Tyco Fire & Building Products LP.
 - b. Victaulic Company.

2.5 SPRINKLERS

2.6 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 minimum.
 3. Acceptable Manufacturers:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 - e. Viking Corporation.
- B. Automatic Sprinklers:
1. Non-residential Applications: UL 199.
 2. Characteristics: Quick-response type with nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- C. Sprinkler Finishes:
1. Painted.
- D. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications.
1. Exposed Pendent Sprinklers: Chrome-plated steel, one piece, flat.
 2. Concealed Sprinklers: White -plated steel, two piece, with 1-inch vertical adjustment and a flat cover plate.
 3. Sidewall Mounting: White coated -plated steel one piece, flat.

2.7 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. 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.
 5. Manufacturers:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.

2.8 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

- B. Split-Casting, Cast-Brass Escutcheons: Polished chrome-plated finish with concealed hinge and set-screw.
- C. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.9 SLEEVES

- A. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.

PART 3 - EXECUTION

3.1 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 in NFPA 13 for installation of sprinkler piping.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes 2" and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having 2-1/2" and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install alarm devices in piping systems.
- I. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13 for hanger materials.
- J. 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 and with soft metal

seated globe valve, arranged for draining pipe between gage and valve. Install gauges to permit removal and install where they will not be subject to freezing.

- K. Drain dry-pipe sprinkler piping.
- L. Pressurize and check dry-pipe sprinkler system piping and air compressors.

3.2 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 2" and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having 2-1/2" and larger end connections.
- D. Ream ends of pipes and tubes and remove burs. 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 burs 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, Cut-Grooved Joints: Cut square-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 joints.
- I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 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. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - a. Install air compressor and compressed-air supply piping.

3.4 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in the center of narrow dimension of acoustic 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.

3.5 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, and walls.
- B. Sleeves are not required for core-drilled holes in cast walls or floors.
- C. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- D. Install sleeves in new partitions, slabs, and walls as they are built.
- E. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- F. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- G. Seal space outside of sleeves in concrete slabs and walls with grout.
- H. 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 firestop materials and installations in Division 07 Section "Penetration Firestopping."

3.6 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 Division 26 Section "Identification for Electrical Systems."

3.7 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. Start and run air compressors.
 - 6. Coordinate with fire-alarm tests. Operate as required.
 - 7. Coordinate with fire-pump tests. Operate as required.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.8 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

END OF SECTION 21 1316

DIVISION 22 PLUMBING

22 0000 General Requirements for Plumbing Systems

- 22 0001 Basic Plumbing Requirements
- 22 0002 Plumbing Work in Existing Buildings
- 22 0004 Firestopping for Plumbing Systems
- 22 0005 Excavation, Backfill and Surface Restoration

22 0500 Common Work Results for Plumbing

- 22 0519 Meters and Gauges
- 22 0520 Common Piping Materials and Methods
- 22 0523 General Duty Valves
- 22 0529 Pipe Hangers and Supports
- 22 0530 Equipment Bases and Supports
- 22 0553 Identification for Plumbing Systems

22 0700 Plumbing Insulation

- 22 0719 Pipe Insulation

22 0800 Commissioning

- 23 0800 Plumbing Commissioning

22 1000 Plumbing Piping and Pumps

- 22 1116 Domestic Water Piping
- 22 1119 Domestic Water Piping Specialties
- 22 1123 Domestic Water Pumps
- 22 1316 Sanitary Waste and Vent Piping
- 22 1317 Acid Waste and Vent Piping
- 22 1319 Sanitary Waste Piping Specialties
- 22 1416 Interior Storm Piping
- 22 1423 Storm Drainage Piping Specialties
- 22 1513 General Service Compressed Air Piping
- 22 1613 – Natural Gas House Piping

22 3000 Plumbing Equipment

- 22 3436 Gas-Fired Storage Water Heaters

224000 Plumbing Fixtures

- 22 4200 Plumbing Fixtures

226000 Gas and Vacuum Systems

- 22 6313 Laboratory Gas and Vacuum Piping

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SECTION 22 0001 – BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes the following:

1. General Requirements
2. Definitions
3. Scope of Work
4. Drawings and Specifications
5. Reference Standards
6. Site Visit
7. Permits, Regulations and Inspections
8. Project Management and Coordination
9. Temporary Utilities
10. Workmanship
11. Protection
12. Painting
13. Cleaning
14. Miscellaneous Equipment Connections
15. Equipment Selection
16. Shop Drawings
17. Final Inspection and Punch List
18. Operation and Maintenance Manuals
19. Record Drawings
20. Warranties
21. Project Closeout
22. Operation and Adjustment of Equipment
23. Operating Demonstration and Instruction
24. Build America, Buy America Act Requirements

1.2 GENERAL REQUIREMENTS

- A. All provisions of Division 00 Front End Documents and Division 01 General Requirements apply to work specified in this Division.
- B. Specification provisions of other relevant Divisions shall apply where applicable work is required to be performed under this Plumbing work.
- C. A complete and functional Plumbing system installation shall be provided under this Division. Should overlap of work among trades become evident, this shall be called to the attention of the architect. In such an event, none of the trades or their suppliers shall assume that he relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

- D. The Mechanical and Electrical drawings and specifications assign work (labor and/or materials to be provided by the General, Plumbing, Fire Suppression, HVAC or Electrical Contractor or their sub-contractors. Understanding that the contractors for mechanical and electrical work are sub-contractors to the (General) Contractor, such assignments are not intended to restrict the Contractor in assignment of work among the sub-contractor to accommodate trade agreements and practices or the normal conduct of the construction work.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, 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.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior 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.

1.4 SCOPE OF WORK

- A. The scope of the Plumbing work includes furnishing, installing, testing and warranty of all Plumbing work shown on the Plumbing drawings and specified herein, including Division 00, Division 01, Division 22 and applicable provisions of other relevant Divisions..

1.5 DRAWINGS AND SPECIFICATIONS

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word "provide," as used, shall mean "furnish and install." If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect for approval before proceeding with the work.
- B. Make all necessary field measurements to ensure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having pipe and fittings fabricated and delivered in advance of making actual measurements shall be sufficiently in advance as to not

cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.

- D. The Architect shall reserve the right to make minor adjustments in locations of system runs and components where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as not to cause extra work or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties.
- E. Equipment or piping shall not be installed or run above electrical switchgear or panelboards, nor in or above the access space in the immediate vicinity of the electrical switchgear/panelboards, in accordance with NEC Article 384.
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Architect's decision shall be final in regard to the arrangement of ductwork, piping, etc., where conflict arises.
- G. Provides offsets in system runs, additional fittings, necessary drains and minor valves, traps, and devices required to complete the installation, or for the proper operation of the system. Each Contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

1.6 REFERENCE STANDARDS

- A. Where standards (NFPA, NEC, ADTM, UL, ASPE, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the authority having jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

1.7 SITE VISIT

- A. Refer to Section 017300 - Execution.
- B. Each bidder shall visit the project site to understand the existing conditions and compare the conditions with information shown on the drawings. Report immediately to the Architect any issues or discrepancies which are discovered that affect the bid. Changes to contract price will not be considered for site condition issues that are readily apparent from a thorough site review.

1.8 PERMITS, REGULATIONS AND INSPECTION

- A. Work must conform to applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawing and specifications shall govern. Install no work contrary to minimum legal standards.

- B. Except where the permit application is made by the Architect or the Engineer, the Plumbing contractor shall be responsible to file for and obtain all required permits from the governing inspection agencies for the plumbing work. Where the Architect or Engineer is the Architect or Engineer of record, they will furnish sealed and signed drawings and specifications required by the permit authorities.
- C. Include payment of all permit and inspection fees applicable to the work in this Division.
- D. All work shall be subject to inspection and approval of Federal, State and local agencies as may be appropriate as well as the Architect and Engineer.
- E. Furnish for the Owner certificates of approval from the governing inspection agencies as a condition for final payment.

1.9 PROJECT MANAGEMENT AND COORDINATION

- A. Refer to Section 013100 Project Management and Coordination.
- B. The HVAC Contractor shall initially prepare and be responsible for 1/4" scale coordination drawings. These drawings shall be reproduced and distributed to the Plumbing, Fire Suppression and Electrical Contractors for their input and revisions. Assure that all contractors work together to obtain finished coordinated drawings and no work being installed until all contractors have approved and signed off with their approval and drawings have been submitted and reviewed by the Engineer.

1.10 TEMPORARY UTILITIES

- A. Refer to Section 015000 – Temporary Facilities and Controls for division of responsibilities for temporary utilities.
- B. Each Contractor requiring water for construction purposes shall connect to wall hydrants or other connection points within the existing building.

1.11 WORKMANSHIP

- A. Refer to Section 014000 - Quality Requirements.
- B. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Architect shall have the right to stop the work if the highest quality workmanship is not maintained.
- C. Plumbing work shall be performed by licensed Plumbing Contractors in accordance with the requirements of the jurisdiction.

1.12 PROTECTION

- A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect.
- B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide plastic sheeting, drop cloths or similar barriers where dust and debris is generated, to protect adjacent areas.
- C. Contractor shall protect all equipment and materials from detrimental effects of weather or construction activity. All items shall be stored and secured in a protected location away from the daily work area. Equipment or materials shall be placed on raised skids to protect from surface moisture. Where appropriate, provide plastic sheeting or similar vapor barrier underneath the stored products to reduce the effects of ground moisture or curing concrete on the local humidity levels. Where unfinished ferrous products or finished ferrous products with raw edges are stored, provide local, dry heat to maintain ambient relative humidity levels below 65% RH to prevent rust.
- D. All equipment shall retain the original packaging until required to be removed for installation or operation. Open ends of piping, conduit, etc. shall be capped or sealed and ventilation openings into equipment shall be wrapped and sealed in plastic sheeting to prevent dust or dirt entry both when stored and after installation but still open to the effects of construction activity. Stored items as well as installed equipment shall be covered with plastic sheeting at all times until placed in service or until dust generating activity in the area has ceased.

1.13 PAINTING

- A. In addition to any painting specified for various individual items of equipment, the following painting shall be included in Division 22:
 - 1. Ferrous metal, which is not factory or shop painted or galvanized, and which remains exposed to view in the finished areas of the building shall be given a prime coat of paint.
 - 2. Ferrous metal installed outside the building which is not factory or shop painted or galvanized shall be given a prime coat of paint.
 - 3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch-up.
- B. Paint, surface preparation and application shall conform to applicable portions of the Painting section of Division 9 of the Specifications. All rust must be removed before application of paint.
- C. Finish painting is included in the General Contract except where otherwise required under remodeling work. Refer to the Cutting and Patching paragraph in this Section for finishing requirements

1.14 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.
- C. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain.

1.15 MISCELLANEOUS EQUIPMENT CONNETIONS

- A. Certain categories of fixtures and equipment, including kitchen equipment, sterilizers, washers, laundry and laboratory equipment, require piping connections and duct connections as shown on the drawings. Equipment will be furnished and set in places by the equipment supplier.
- B. Make all final connections to these fixture and equipment, as indicated and in accordance with the manufacturer's recommendations. All piping connections shall be valved and final connections made with unions.
- C. Fixtures and equipment, unless otherwise noted, will be furnished complete with the basic plumbing supply and waste trim. The trim will generally be furnished "loose" and shall be installed under this work. Countertop sinks furnished "loose" shall also be installed by the Plumbing Contractor.
- D. Provide supplies, supply stops, traps, shut-off valves, fixture drains, continuous wastes and indirect wastes. Provide a water-hammer arrestor on the system side of each automatic (quick-closing) valve on water supply lines. Items not specifically described elsewhere in these specifications shall be of the same manufacturer as similar items specified in conjunction with the plumbing fixtures.
- E. Supply piping and devices connecting to lab equipment, where exposed to view in the finished space, shall be chrome plated and insulation shall be omitted.
- F. Roughing-in drawings shall be obtained for the various fixtures and items of equipment as the time approaches when such information is required; allow a reasonable period, from the time of notice to obtain this information.
- G. Connections to equipment shall be in accordance with manufacturers' installation guidelines. Any additional accessories recommended by the manufacturer such as gauges, shut-off valves, unions at connection points, etc., shall be provided by this Contractor.

1.16 EQUIPMENT SELECTION

- A. Materials and equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.
- B. The selection of materials and equipment to be furnished under this contract shall be governed by the following:
 - 1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specifications, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturers listed.
 - 2. Where the words “or approved equal: appear after a manufacturer’s name, specific approval must be obtained from the Architect during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
 - 3. Where the words “equal to” appear, followed by a manufacturer’s name and sometimes a model or series designation, such designation is intended to establish a model or series designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer’s approval.
- C. Substitute equipment of equal quality and capacity will be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.
- D. Before bidding equipment, and again in the preparation of shop drawings the Contractor and his supplier shall verify that adequate space is available for entry and installation of the item of equipment, including associated piping and accessories. Also verify that adequate space is available for servicing of the equipment.
- E. If extensive changes in pipe, or equipment layout or electrical wiring and equipment are brought about by the use of equipment which is not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in the contract.

1.17 SHOP DRAWINGS

- A. Refer to Section 016000 - Product Requirements.
- B. These shall be submitted as soon as practicable and before special equipment is manufactured and before installation.
- C. Shop drawings for equipment fixtures, devices and materials shall be labeled and identified same as on the Contract Documents. Failure to do so may be cause for rejection of shop drawings.

- D. The review of shop drawings by the Architect or Engineer shall not relieve the Contactor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.
- E. Shop drawings for the following Plumbing equipment and materials shall be submitted:
 - 1. Pipe, fittings and joining methods for the various systems.
 - 2. Firestopping systems for pipe penetrations.
 - 3. Pipe hangers and saddles.
 - 4. Valves.
 - 5. Gauges.
 - 6. Pipe insulation
 - 7. Supply system specialties.
 - 8. Backflow preventers
 - 9. Drainage system specialties
 - 10. Plumbing fixtures and trim
 - 11. Water heating equipment
 - 12. Laboratory gases equipment and accessories

1.18 OPERATING AND MAINTENANCE MANUALS

- A. Refer to Section 017823 - Operation and Maintenance Data.
- B. All shop drawing and installation, maintenance and operating instruction pamphlets or brochures, wiring diagrams, parts list and other information, along with warranties, shall be obtained from each manufacturer of the principal items of equipment. In addition, the Contractor shall prepare a chart listing all items of equipment which are furnished under his contract and indicating the nature of maintenance required, the recommended frequency of checking these points and the type of lubricating media or replacement material required.
- C. These shall be assembled into three-ring loose lead binders or other appropriate binding and also combined into a single electronic file in .PDF format. An index and tabbed sheets to separate the sections shall be included. These shall be submitted to the Architect or Engineer for review. Upon approval, manuals shall be turned over to the Owner.

1.19 RECORD DRAWINGS

- A. Refer to Section 017839 - Project Record Drawings.
- B. Each Contractor shall maintain a separate set of prints of the contract documents and shall show all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work, these drawing shall be turned over to the Architect.

1.20 WARRANTIES

- A. This Contractor shall warrant all workmanship, equipment and material entering into this contract for a period of one year of date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect. Any materials or equipment proving to be defective during this warranty period shall be made good by this Contractor without expense to the Owner.
- B. This provision is intended specifically to cover deficiencies in contract completion or performance which are discovered after systems are placed in operation. Also included shall be supplementary assistance in balancing, adjusting or providing operating instructions as the need develops, and replacing overload heater elements in starters where necessary to keep systems in operation. Heater element sizes shall not exceed the motor manufacturer's recommendations.
- C. This provision shall not be construed to include maintenance items such as replacing filters, and cleaning strainers after these have been done for final close-out.
- D. Provisions of this warranty shall be considered supplementary to warranty provisions under General Conditions.

1.21 PROJECT CLOSEOUT

- A. Refer to Section 017700 - Closeout Procedures.

1.22 OPERATIONS AND ADJUSTMENT OF EQUIPMENT

- A. As each piping system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing the domestic hot water return system,
- B. Caution: Verify that all bearings are lubricated, all motors are operating in the right direction, and correct overload heater elements are provided on all motors. Do not depend wholly on the electrician's judgment in these matters. Follow specific instructions in regard to lubrication. Do not oil or grease presealed ball bearings unless upon manufacturer's specific instructions.
- C. Test relief valves, air vents and regulating valves to ensure proper operation.

1.23 OPERATING DEMONSTRATION AND INSTRUCTIONS

- A. Refer to Section 017900 Demonstration and Training as well as individual Division 22 Sections for requirements.
- B. The Contractor shall set the various systems into operation and demonstrate to the Owner and Architect that the systems function properly and that the requirements of the Contract are fulfilled.
- C. The Contractor shall provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.

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- D. A minimum of 4 hours shall be allowed for instructions to personnel selected by the Owner. Instructions shall include not less than the following:
1. Show locations of items of equipment and their purpose.
 2. Review binder containing instructions and equipment and systems data.
 3. Coordinate written and verbal instructions so that personnel understand each.

1.24 BUILD AMERICA, BUY AMERICA ACT REQUIREMENTS

- A. This project will receive Federal funding. Therefore, product and materials procured for the project must comply with the Build America, Buy America Act (BABA). Refer to the City of Dayton General Provisions and Supplemental Specification for compliance requirements.
- B. The Contractor must maintain a complete list of construction material, product, and manufacturers' certifications for product used in the project in order to verify (BABA) compliance.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION– NOT APPLICABLE

END OF SECTION 22 0001

SECTION 22 0002 – PLUMBING WORK IN EXISTING BUILDINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section Includes the following:
1. General Requirements for Renovation Work
 2. Inspection of Existing Building
 3. Asbestos Material
 4. Work Hours
 5. Tobacco Products
 6. Barriers and Signage
 7. Storage of Tools and Materials
 8. Protection of Existing Building and Equipment
 9. Confined Spaces
 10. Noise, Fumes and Dust Control
 11. Soldering Welding and Cutting
 12. Removals Disposal and Reuse
 13. Draining, Flush and Refill of Piping Systems
 14. Continuity of Systems
 15. Cutting and Patching
 16. Cleaning

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 GENERAL REQUIREMENTS FOR RENOVATION WORK

- A. Refer to Article 1 Specification requirements and notes on the drawings where provided for requirements related to renovation work.
- B. Meet with the Owner, Architect and Engineer before demolition or construction begins to establish procedures for work effort in the existing building. Provide names and phone numbers and establish emergency contact information where work is performed. Provide security information requested by the Owner for all personnel who will be working on site. Educate all construction personnel in regard to the project requirements and procedures.
- C. Coordinate effort with other contractors involved in the renovation project to minimize the disruption, phasing of work, share cleaning responsibilities, etc.

1.4 INSPECTION OF EXISTING BUILDING

- A. Each bidder shall inspect the project site and the existing building in the early time frame of the bidding period. Conditions shall be compared with information shown on the drawings. Report to the Architect/Engineer any significant discrepancies which may be discovered in a timely fashion so that direction may be provided in an addendum. After the contract is signed, no allowance will be made for failure to have made a thorough inspection.

1.5 ASBESTOS MATERIAL

- A. Abatement, removal or encapsulation of existing materials containing asbestos is not included in the Contract. Necessary work of this nature will be arranged by the Owner to be done outside of this construction and remodeling project by a company regularly engaged in asbestos abatement. Such work will be scheduled and performed in advance of work in the construction and remodeling project.
- B. If, in the performance of the mechanical work, materials are observed which are suspected to contain asbestos, the Contractor shall immediately inform the Architect who in turn will notify the Owner. Work that would expose workers to the inhalation of asbestos particles shall be terminated. Work may be resumed only after a determination has been made and unsafe materials have been removed or encapsulated and the area declared safe.

1.6 WORK HOURS

- A. Work hours for construction shall be as defined in Section 01150- Project Phasing or other specification sections or drawing notes.
- B. Where allowed, contractors may work normal hours except after hours is required for operations that are noisy, generate obnoxious fumes or dust, require shut down of ventilation systems, etc. The Owner reserves the right to stop normal hour work where the Owner deems the effort to be disruptive to their ongoing operations.
- C. Any work that creates hazards in or requires closure of corridors, exit pathways or stairwells work in corridors must be performed after hours when the building is not occupied.
- D. All occupied areas, corridors, exit pathways, and stairwells must be left clean, lighted (including emergency egress and exit signage) usable and safe at the end of each work shift.
- E. Access to the work area shall be coordinated with the Owner; follow all security protocols for parking, sign in, key control, etc. established by the Owner.

1.7 TOBACCO PRODUCTS

- A. Smoking or chewing tobacco products are expressly prohibited to be used within the building and on the premises except where specifically permitted by the Owner or in construction company trailers or vehicles where permitted by the construction company.

PART 2 - PRODUCTS- NOT APPLICABLE

PART 3 - EXECUTION

3.1 BARRIERS AND SIGNAGE

- A. Barriers and signage shall be provided as appropriate to identify work areas and to prevent unauthorized entry by non construction personnel. Refer to appropriate Division 1 specification requirements and notes on the drawings where provided.
- B. All barriers and signs should be high visibility type and be maintained at all times.

3.2 STORAGE OF TOOLS AND MATERIALS

- A. Store all site material and tools in the active job site area, specific storage areas are not provided except where otherwise noted for material and tools. The contractor is responsible for security.
- B. Storage is specifically prohibited in means of egress paths and stairwells.

3.3 PROTECTION OF EXISTING BUILDING AND EQUIPMENT

- A. The Owners' property and the property of other contractors shall be respected at all times. Provide drop clothes, visqueen or other suitable barriers where dust and debris is generated. Tape ends of barriers for sealing purposes.
- B. Provide 55 gallon drums or smaller buckets as appropriate and use funnels where draining liquid systems.
- C. Provide plywood sheets for protection of walls, floors or Owner equipment or systems that are remaining in place near demolition or new installation work where there is possible damage from heavy material or equipment.

3.4 CONFINED SPACES

- A. Notify the Owner when performing work in confined spaces. Provide a written procedure for approval and obtain approval from the Owner when so requested.
- B. All work in confined spaces shall be done in accordance with OSHA regulations.

3.5 NOISE, FUME, AND DUST CONTROL

- A. Provide barriers and ventilation as required to limit the effect from construction generated noise fume and dust control on spaces that continue to be occupied by the Owner. Refer to protection of building and equipment paragraph above. In addition to the basic protection, provide additional visqueen barriers to limit airborne migration of dust and fumes. Provide supplemental portable fans to exhaust air to the outside of the building where appropriate. Use of the Owners' ventilation systems to induce positive or negative pressure is prohibited unless authorized by the Owner. Shut off ventilation systems serving the area where use of these systems can induce fumes or dust into return or exhaust ducts. Where systems need to remain operational for occupied areas, arrange to temporarily shut off portions of the system in the work area. Provide taped visqueen covers on HVAC air supply and exhaust devices to limit migration. Coordinate all efforts requiring modification or shutdown of ventilation systems with the Owner. Contractor shut down of these systems is prohibited without Owner permission.
- B. Arrange with the Owner when required to shutoff fire alarm or smoke detectors to perform work. With the Owners' prior approval. Cover smoke detectors where needed to prevent false alarms due to work generated dust or fumes. Minimize outages and coordinate efforts to limit the effect due to false alarms.
- C. Where significant dust or fume generating work, welding or cutting operations are required for removal or new work, provide fume removal equipment with telescoping arms to locally capture the fumes. Fume exhaust shall be directed outside or adequately filtered and recirculated.
- D. Areas shall be thoroughly ventilated after completion of the work on a daily basis to remove residual odors and fumes before occupancy occurs the next day.
- E. Provide vacuum cleaners and other equipment to clean and restore conditions.

3.6 SOLDERING WELDING AND CUTTING

- A. For soldering, welding or cutting operations, provide insulated, fire rated barriers and blankets to isolate cover and protect remaining systems and materials, furniture, furnishings, floors, walls, ceilings, etc.
- B. Refer to noise, fume and dust control provisions in the previous paragraph.
- C. Obtain burn approval from the Owner before commencing any soldering or welding effort. Coordinate outages of fire alarm systems as noted in the previous paragraph.

- D. Provide a Fire Watch at each welding location. Fire Watch personnel shall be dedicated for the sole purpose of fire prevention during welding operations. All Fire Watch personnel shall be properly trained and equipped, including fire extinguishers, fire blanket and communication equipment for assistance request.
- E. Provide a fire extinguisher at every soldering or welding location.

3.7 REMOVALS, DISPOSAL, AND REUSE

- A. Refer to the drawings for the scope of remodeling in the existing building.
- B. Cooperate with the General Contractor regarding all removal and remodeling work. Each Contractor shall remove existing work which is associated with his trade, and which will be superfluous when the new work is installed and made operational.
- C. Extraneous piping which is or becomes accessible shall be removed and stubs shall be capped at the first active pipe encountered. Piping that is and remains inaccessible shall be abandoned. Ends of abandoned pipe shall be capped so as to be concealed by finished surfaces. Upon completion of the work no abandoned duct. Pipe, valve or stub shall extend through finished floors, walls or ceilings.
- D. When it is necessary to reroute a section of active piping the rerouted section shall be installed before removing the existing in order to minimize system downtime. Rerouted sections shall be insulated as required for new work. Patch insulation on existing piping which has been damaged or removed in this work.
- E. Where existing piping is removed and holes are left in existing walls, finished ceilings, floors, etc., these holes shall be patched using materials to match the existing construction to restore and maintain the integrity of the existing partition.
- F. Materials and equipment which are removed shall not be reused within the scope of this project unless specifically noted to be relocated or reused. Turn over to the Owner and place where directed on the premises all removed material and equipment so designated by the Owner. All material and equipment which the Owner does not wish to retain shall become the property of the Contractor responsible for removal and shall be removed from the premises and properly disposed.
- G. Disposal of materials regulated by EPA shall be done in strict accordance with the latest requirements. Provide documentation to the Owner that disposal was properly executed.
- H. Remove, store and reinstall lay-in ceiling tile and grid as needed to perform work in areas where such removal and re-installation is not to be done by the General Contractor. Damaged tile and/or grid shall be replaced with new matching tile and/or grid.
- I. In areas of minor work where the space is not completely vacated, temporarily move portable equipment and furnishings within the space as required to complete the work. Coordinate this activity with Owner. Protect the Owner's property by providing dust covers and temporary

plastic film barriers to contain dust. Remove barriers and return equipment and furniture upon completion of the work.

- J. Refinish any surface disturbed under this work match existing, except where refinishing of that surface is included under the General Contract.

3.8 DRAINING, FLUSHING, AND REFILL OF PIPING SYSTEMS

- A. Existing liquid systems shall be drained as required before removal or connection of new piping extensions.
- B. Draining of the system shall be the responsibility of the contractor. Provide threaded connections, etc. to direct fluids to drainage points. Water systems may be drained to sanitary systems or where permitted, to storm systems. Verify any chemical treatment, inhibitors or freeze protection additives in the existing systems and obtain a permit from the local sewer authority before disposing.
- C. Provide drums or containers to accept other than water drainage and remove from the premises and properly dispose. Provide visqueen to protect Owners' property when opening pipes, even where piping has been drained to prevent damage from residual liquid that remains in the pipe.
- D. After new piping is connected and tested, flush clean and disinfect all existing piping that has been drained and new piping as specified in Section 22001, Basic Plumbing Requirements. Provide full port, 0.75" ball valves with hose connectors as described to facilitate flushing operations.

3.9 CONTINUITY OF SYSTEMS

- A. Work shall be so planned and executed as to provide reasonably continuous services of existing systems throughout the construction period. Where necessary to disrupt services for short periods of time for connection, alteration or switch-over, the Owner shall be notified in advance and outages scheduled at the Owner's reasonable convenience.
- B. Submit, on request, a written step-by-step sequence of operations proposed to accomplish the work. The outline must include tentative dates, times of day for disruption, downtime and restoration services. Submit the outline sufficiently in advance of the proposed work to allow the Architect or Engineer to review the information with the Owner. Upon approval, final planning and the work shall be done in close coordination with the Owner.
- C. Shutdown of systems and work undertaken during shutdown shall be bid as being done outside of normal working hours.

3.10 CUTTING AND PATCHING

- A. Refer to Division 1 – General Requirements for information regarding cutting and patching.

- B. Plan the work well ahead of the general construction. Where pipes are to pass thru new walls, partitions, floors, roof or ceilings, place sleeves in these elements or arrange with the General Contractor to provide openings where sleeves are not practical. Where sleeves or openings have not been installed, cut holes and patch as required for the installation of this work, or pay other trades for doing this work when so directed by the Architect. Any damage caused to the building shall be repaired or rectified.
- C. Where pipes are to pass through, above, or behind existing walls, partitions, floors, roof or ceiling, cutting, patching and refinishing of same shall be included in this contract. Core drilling and saw cutting shall be utilized.
- D. All material, methods and procedures used in patching and refinishing shall be in accordance with applicable provisions of specifications governing the various trades. The final appearance and integrity of the patched and refinished areas must meet the approval of the Architect. Wall, floor and ceiling refinishing must extend to logical termination lines (entire ceiling of the room repainted, for instance), if an acceptable appearance cannot be attained by finishing a partial area.
- E. Provide steel angle or channel lintels to span openings which are cut in existing jointed masonry wall where the opening span exceeds 16 inches. Provide framing around roof openings for required support of the roof deck.

3.11 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.
- C. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain. The contractor shall also clean duct interiors and interior components of new or existing air handling system equipment if dirt, dust or debris have generated in the course of work have accumulated on these surfaces.

END OF SECTION 22 0002

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SECTION 22 0004 – FIRESTOPPING FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestopping systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Firestopping assemblies shall be tested and rated in accordance with ASTM E814 (ANSI/UL 1479) Fire Tests of Through-Penetration Fire Stops (minimum positive pressure of .01 inches of water column) and E119 (ANSI/UL 263) Fire Tests of Building Construction and Materials Time-Temperature Curve. Firestopping shall provide an “F” fire rating equal to that of the construction being penetrated. Firestop systems shall meet all requirements of the Ohio Building Code.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - 2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view or above ceilings in air return plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Firestopping materials shall be manufactured and/or supplied by:
 - 1. Hilti, Inc.
 - 2. Johns Manville.
 - 3. Nelson Firestop Products.
 - 4. Specified Technologies Inc.
 - 5. 3M; Fire Protection Products Division.
 - 6. Tremco; Sealant/Weatherproofing Division.

2.2 FIRESTOPPING

- A. Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. These shall be installed in conjunction with sleeves and materials for filling and damming.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.
- B. Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.
- C. Provide firestop system for every pipe at penetration of all fire resistance rated walls and horizontal assemblies.
- D. Coordinate opening size and additional framing requirements with the General Contractor for each opening to meet the firestop installation requirements.
- E. Annular space of penetrations of non-fire-resistant-rated floor, floor/ceiling assemblies, or the ceiling membrane of a non-fire-resistant rated roof/ceiling assembly shall be filled with an approved firestopping material to resist the free passage of flame and products of combustion.

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- F. Smoke Barriers:
 - 1. Penetrations shall be sealed with a firestopping system to prevent the passage of smoke.
- G. Smoke Partitions:
 - 1. Penetrations shall be sealed with a caulking material to prevent the passage of smoke. Non-rated smoke partitions do not require a fire stopping system.

END OF SECTION 22 0004

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SECTION 22 0005 – EXCAVATION, BACKFILL AND SURFACE RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Excavating and backfilling for utility trenches.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 DEFINITIONS

- A. Backfill: Soil 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. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- D. 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 Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- E. Fill: Soil materials used to raise existing grades.
- F. 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.
- G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below topsoil materials.

- H. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

1.5 GENERAL

- A. Excavate for all in-grade, under-floor piping and incidental work which are included in the Plumbing contract. Backfill to finish grade or to levels consistent with the General Contractor's and Site Contractor's activities. Cut existing street, drive and parking lot paving, walks, curbs and other permanent hard surfaces which are to be encountered. Repair or restore exterior surfaces to original condition where such are not affected by Division 2 – Site Work. Cut existing floor slabs and replace slabs in conformance to 22 0002.
- B. Excavation and trench wall supporting, cribbing, sloping and stepping of excavations required for safety shall be done in accordance with OSHA and local requirements. Pumping of water from excavations and trenches which may be required during construction shall be included in this contract.
- C. Contact the Ohio Utilities Protection Service (1-800-362-2764) well in advance of the start of any excavation to determine if any of the utility companies or departments have underground utilities in or near the project area.
- D. Contact local water and sewer departments, gas company, electric company, telephone company, etc., regarding the possibility of encountering existing utilities. The integrity of all existing utilities shall be respected.
- E. Existing utilities encountered during excavation work shall be protected in a manner acceptable to the utility owner. Any utilities that are damaged shall be repaired or replaced by the Contractor to the full satisfaction of the utility owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Bedding Course: Naturally or artificially graded natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- B. 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 (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

PART 3 - EXECUTION

3.1 EXCAVATION FOR UTILITY TRENCHES

- A. Trenches for interior and exterior piping shall be over-excavated and the pipe shall be laid on 6" minimum depth sand bed.
- B. Backfilling of excavations and trenches inside the building and outside under paved or other hard surfaced areas, shall be with graded pea gravel, graded coarse sand or compacted, crushed limestone, 3/4" maximum size, to prevent undue settlement. Backfill material for plastic piping shall be pea gravel or sand. Other excavations and trenches shall be backfilled with similar materials up to 18" above the top of the piping. The remainder shall be with similar materials or with excavated material having no large clods, stones or rocks.
- C. Maintain in place adequate barricades, guards, planking, plating signage, warning lights, etc., at and around excavations.
- D. Backfill shall be mechanically compacted in layers not over 6" deep. Water settling will not be permitted. Where excavations have not been properly filled or where settlement occurs, they shall be refilled, compacted, smoothed off, and finally made to conform to the initial requirements. Excess excavated materials shall be removed from the site or disposed of as directed by the General Contractor. Refer to Division 31 Earthwork for compaction requirements.
- E. Concrete floor slabs, paving, sidewalks, curbs sodded and other finished surfaces which have been damaged or removed in order to install the underground work shall be replaced but this Contractor equal to original conditions. Refer to Division 32 for Surface Restoration requirements. This requirement is not applicable in areas where the General Contractor or the Site Contractor is obligated to provide new surfaces.
- F. Excavation, backfill, surface repair and traffic control within the public right-of-way shall be in accordance with governing agency rules and regulations. Any fee for activity in the roadways shall be included in this contract so that no additional cost will accrue to the Owner.
- G. All exterior underground piping shall be protected against future excavation damage by placing a plastic tape warning marker in each trench during backfill. Tape shall be 6' wide with black letters identifying the piping service. Tape shall be equal to that manufactured by Seton. Install tape full length of the trench approximately 18' above and on the centerline of the pipe.

END OF SECTION 22 0005

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SECTION 22 0519 - METERS AND GAUGES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermometers.
2. Gauges.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 THERMOMETERS

- A. Thermometers shall be 9" blue reading organic spirit filled tube column type with cast aluminum case with epoxy finish, acrylic window, aluminum scale with white background and black markings, 1% accuracy, adjustable angle hinge assembly and 3.5" aluminum insertion stem, equal to Terice BX91403.
- B. Thermometers shall be 5" diameter dial face bi—metallic type with adjustable angle hinge, stainless steel insertion stem and recalibration feature, equal to Terice B85604.
- C. Provide a separable socket insertion thermowell shall be furnished with each thermometer. An extension neck, with appropriate increase in thermometer stem length, shall also be furnished where insulation thickness exceeds 2".
- D. Ranges of thermometers shall be selected from standard Fahrenheit scales to be consistent with anticipated temperatures, typically 0 deg.F.- 160 deg.F.

2.2 PRESSURE GAUGES

- A. Pressure gauges, including compound gauges and vacuum gauges, shall be Bourdon tube type with 4-1/2" dial and cast aluminum case, equal to Terrice 600C Series. Accuracy shall be 1% at mid-range.
- B. Pressure gauges for low pressure application, calibrated in inches of water gauge, ounces per sq. in. or 0-5 psi, as appropriate, shall be equal to Terrice 860.
- C. Pressure gauges at pumps shall be liquid filled Bourdon tube type with 4" dial and stainless steel case and internals, equal to Terrice 700 Series.
- D. A brass cock or bronze ball valve and a pressure snubber shall be furnished with each pressure gauge.
- E. Ranges of pressure gauges shall be selected to be consistent with anticipated pressures. Range shall be approximately twice the normal system working pressure at the gauge location.

2.3 TEST PLUGS

- A. Pressure-temperature test plugs for insertion of pressure gauge or thermometer shall be a brass fitting with neoprene or Nordel self-sealing insert and knurled brass cap with plastic capture tab. Fittings shall be equal to Peterson "PT". Furnish two thermometers and two pressure gauges with integral insertion stem appropriate for use with the test plugs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Thermometers shall be installed where shown on the drawings and also at:
- B. Pressure gauges shall be installed where shown on the drawings, where required by applicable codes and also at:
- C. Thermometers and gauges shall be positioned to be read with unobstructed view from the floor. Pressure-temperature test plugs shall be installed where shown, located in a position to be most readable.
- D. Install thermometer wells in piping tees in the vertical position. Fill the well with oil or graphite and secure the thermometer in position

END OF SECTION 22 0519

SECTION 22 0520 – COMMON PIPING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Dielectric fittings.
2. Mechanical sleeve seals.
3. Sleeves.
4. Escutcheons.
5. Grout.
6. Piping Systems - Common Requirements.
7. Equipment installation requirements common to equipment sections.

1.2 RELATED REQUIREMENTS

A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- B. Welders shall be qualified and fully certified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.
- C. Welding procedures and testing shall comply with ANSI Standard B31.1.0 Standard Code for Pressure Piping, Power piping and The American Welding Society Welding Handbook.
- D. All pressure piping systems regulated by the Ohio Pressure Piping Systems Code, Chapter 4101:8 shall conform to applicable requirements of the Code. Welders shall carry a current State of Ohio, Pressure Piping Board Certification. Each welder shall submit a copy of their signed performance qualification record to the Engineer for approval prior to beginning work on any pressure piping system.
- E. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 DIELECTRIC CONNECTORS

- A. A dielectric connector shall be incorporated at each connection between ferrous and copper piping. Connectors shall be:
 - 1. Dielectric coupling with non-conductive polymer liner, Lochinvar Corp. "V-line" Dielectric fitting on services 180 degrees and less.
 - 2. Dielectric flange with non-metallic bolt hole grommets and gasket.
- Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F .

2.2 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM/NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Plastic. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 SLEEVES

- A. Schedule 40 black steel pipe or 18-gauge galvanized steel poured concrete floors, walls and roof decks.
- B. 26-gauge galvanized sheet or Schedule 40 clack steel pipe in the other than poured concrete.
- C. Cast iron pipe or Schedule 40 galvanized steel pipe in exterior walls below grade, with intermediate wall stop and anchor collar set in place before concrete pouring. Sleeve shall be a part of the sealing assembly. When the wall opening is core drilled the wall sleeve may be omitted. A mechanically compressed rubber sealing assembly equal to Thunderline Corp. "Link-Seal" shall be placed in the annular space between pipe and sleeve or core drilling.
- D. Galvanized sheet metal for existing pipes passing thru new poured concrete floors (18 gauge) and thru new walls and partitions (26 gauge)
- E. Combination pre-set floor sleeve and firestopping assembly equal to Hilti CP 680.

- F. Concrete curbs may be formed and poured around multiple pipe risers in rooms with waterproofing floor membrane, in lieu of the Smith 1720 riser sleeve and clamping ring. Curbs shall be 4" wide x 4" high with chamfered corners. Membrane and curbing shall be arranged to maintain the integrity of the membrane. Pipe sleeves shall be as described for normal areas or extended to the top level of the curb where the concrete is full depth throughout the curbed area.

ESCUTCHEONS

- G. Escutcheon plates shall be split-ring chromium plated pressed steel. Plates shall be sized to cover the surface penetration and sleeve. Plates shall be installed on exposed piping in finished rooms and areas where pipes penetrate walls, floors, ceilings or overhead structure.

2.4 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and non-metallic, 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.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. 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 Coordination Drawings.
- B. Pipe and tubing shall be cut and fabricated to field measurements and run parallel to normal building lines. Pipe ends shall be cut square and ends reamed to remove burs. The pipe interior shall be cleaned of foreign matter before erection of the pipe.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. 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.
- E. Piping shall not be run above electrical switchgear or panelboards, nor above the access space in the immediate vicinity of the equipment, in accordance with N.E.C. Article 384.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Install piping to permit valve servicing.

- H. Install piping adjacent to equipment and specialties to permit servicing and maintenance.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install piping to allow application of insulation.
- L. Select system components with pressure rating equal to or greater than system operating pressure.
- M. Install escutcheons for penetrations of walls, ceilings, and floors.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- O. Verify final equipment locations for roughing-in.

3.2 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping 2" and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping 2-1/2" and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.3 PIPE SLEEVES

- A. Pipe sleeves, floor and wall openings, water protective curbing and escutcheon plates shall be provided as described below. Pipe sleeves shall be placed in all floor slabs, poured concrete roof decks, walls and partitions, except as noted below, to allow new piping to pass thru and allow for expansion, contraction and normal movement of the pipe. Sleeves are also required for all existing piping related to the various trades in new walls, partitions, floors and roof slabs, same as for new piping.
- B. Sleeves are not required in the following:
 - 1. In floor slabs on grade.
 - 2. In stud and gypsum board or plaster walls and partitions which are not fire rated.
 - 3. For uninsulated pipe passing thru masonry walls and partitions and stud and gypsum board or plaster walls and partitions.

4. In core drilled openings in solid concrete not requiring water protection. Sleeves are required, however, at core drilling through hollow pre-cast slabs and concrete block walls, to facilitate containment of required firestopping material.
 5. In large floor openings for multiple pipe and duct risers which are within a fire rated shaft, unless the opening is to be closed off with concrete or other material after pipe are set.
- C. Length of wall sleeves shall be such that the sleeve ends are substantially flush with both sides of the wall or partition. Floor sleeves shall be flush with the bottom and top of the floor slab except, in mechanical rooms and other areas which might have water on the floor, sleeves shall project a minimum of 1" above finished floor. Pipe sleeves shall be sized to allow insulation to pass thru the sleeve, for insulation requiring continuous vapor barrier (domestic cold water, chilled water refrigerant, etc.). Where vapor barrier continuity is not needed, the sleeve may be sized to pass the pipe only or the insulation as well. Refer to the following paragraph for qualification and exceptions relating to firestopping.

Pipe sleeves which are part of firestopping assemblies shall conform to the requirements of the assembly with particular emphasis regarding size, annular space, length, passage or non-passage of insulation and the installation of the sleeves.

- D. Where firestopping is not required, the annular space between the sleeve, core drilling or opening and the pipe or pipe insulation shall be closed with caulking to retard the passage of smoke.
- E. Where uninsulated pipes requiring no pipe sleeves pass thru non-fire rated floor, wall or partition, the annular space shall be closed with material and methods compatible with the wall or partition material (Type M masonry grout, drywall joint compound, plaster, etc.).

3.4 Mechanical Seals

- A. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- B. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 GROUTING

- A. Mix and install grout for plumbing 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 22 0520

SECTION 22 0523 – GENERAL DUTY VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.
2. Check valves.
3. Gate valves.
4. Balancing-Shutoff valves.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America act (BABA) compliance requirements.

1.3 RELATED SECTIONS

1. Division 22 Plumbing piping Sections for specialty valves applicable to those Sections only. Section 22 0553 "Identification for Plumbing Systems" for valve tags and schedules.
2. Valves for natural gas, compressed air vacuum systems are specified in the system specification. See appropriate Division 22 specification.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- C. Sweat end valves of equal construction and features are acceptable in lieu of those specified with screwed ends. Valves of equal construction and features with ends compatible with mechanical joint couplings are acceptable on such systems, and may be manufactured by the coupling system manufacturer. Grooved end valves shall conform to ANSI/AWWA Standard C-606.
- D. Ball valves in piping which is to be insulated shall have extended shaft necks to accommodate the insulation.

- E. All valve for Domestic potable water systems (cold, hot hot return, etc.) shall be “lead free” in accordance with the Federal Safe Water Act (S3874) definition and NSF/ANSI-61 approved

PART 2 - PRODUCTS

- 2.1 Refer to valve schedule on the Drawings for piping material and applications.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Drain valves shall be the same as for the shut-off service. Provide a $\frac{3}{4}$ ” hose thread adapter on the outlet of each drain valve that is not piped to a drainage point. Hose thread adapters on drain valves of potable water piping shall be fitted with a non-removable vacuum breaker.
- B. Internals shall be removed and the remaining elements of sweat end valves shall be protected against heat damage during soldering or brazing
- C. Valves shall be installed with the stem at or above the centerline of the pipe. Valves shall be located to be accessible for operation, servicing and/or removal.
- D. Packing glands shall be tightened before placing the valves in service.

END OF SECTION 22 0523

SECTION 22 0529 – PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal hanger shield inserts.
 - 4. Hanger Rods and Attachments.
 - 5. Pipe Riser Supports

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design seismic-restraint hangers and supports for piping and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal hanger shield inserts.
 - 3. Powder-actuated fastener systems.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS

- A. Hangers and supports for piping shall be equal to the Anvil catalog numbers as follows:
1. General service - clevis type - Fig. 260.
 2. Uninsulated copper tubing - copper plated clevis type - Fig. CT-65 (or plastic-coated clevis, or fiberglass construction).
 3. Where the length of the hanger rod between the top of the hanger and the attachment is 3" or less, clevis type hangers with rollers, Fig. 181, shall be used to allow for expansion travel
- B. Hangers on insulated horizontal piping shall be oversized to surround the pipe insulation. To protect the insulation from damage or inordinate compression due to concentrated weight, the following shall be provided at each hanger:
1. Pipe 2" and smaller – Anvil Fig. 168 18 ga. sheet metal rib-lock shield with belled ends, 12" long.
 2. Pipe 2-1/2" and larger – Factory fabricated assembly equal to Pipe Shields, Inc. A1000.
- C. The first two hangers on piping connecting to motor driven equipment shall be fitted with a steel spring and neoprene vibration isolation section similar to Mason Industries, No. 30N.

2.2 TRAPEZE HANGERS

- A. Trapeze hangers for numerous pipes run in parallel may be utilized. Horizontal support members shall be unistrut type section with pipe rollers (to allow for expansion travel) and spring and nut connectors, suspended with hanger rods and attachments similar to individual pipe hanger suspension.

2.3 HANGER RODS AND ATTACHMENTS

- A. Hanger rods shall be solid steel, threaded end or all-thread rod, of diameter listed below or matching manufacturer's provisions. A hanger attachment device (for attachment to the structure) and locking nuts at the hanger attachment shall be provided on each hanger. Locking nuts shall be provided at each clevis hanger.

<u>Pipe Size</u>	<u>Min. Rod Dia.</u>
1" and smaller	1/4"
1-1/4" to 3"	3/8"
4" to 6"	1/2"

B. Hanger rod attachment devices for attachment to the structure shall be:

1. Beam clamps for steel construction equal to Anvil Fig. 92, 93, or 94. Utilize swivel type in sloped steel construction to provide vertical support of pipe without bending hanger rods.
2. Channel support system equal to Unistrut or Hilti.

2.4 PIPE RISER SUPPORTS

A. Riser clamps on cold service insulated piping shall be:

1. Insulated Pipe size 1-1/2" and smaller shall be factory (Pipe Shields E1000) or shop fabricated assembly Fig. 261 with high density calcium silicate insulation and galvanized steel jacket.
2. Insulated Pipe size 2" and greater shall be factory fabricated assembly Pipe Shields, Inc. E1000.
3. Un-insulated copper tubing – Anvil Fig CT-121 or CT-121C
4. Un-insulated steel piping – Anvil Fig. 261.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Spacing of hangers shall be as follows:

1. Steel pipe - Vertical:
 - a. At the base and 15 ft. maximum spacing unless otherwise shown.
2. Steel pipe - Horizontal:
 - a. 2" size and smaller – 8 ft. intervals
 - b. 2-1/2" thru 6" – 10 ft. intervals
3. Cast iron pipe - Vertical
 - a. At the base and 15 ft. maximum spacing unless otherwise shown.
4. Cast iron pipe – Horizontal
 - a. At 10 ft. intervals.
 - b. Support each length of pipe not more than 18" from the joint.
 - c. Support terminal ends of horizontal runs and branches and each change in direction.
 - d. 5" and larger provide bracing to prevent horizontal movement in accordance with CISPI "Soil Pipe and Fittings Handbook"
5. Copper Tubing - Vertical
 - a. At the base and 10 ft. maximum spacing unless otherwise shown.

6. Copper Tubing – Horizontal
 - a. 1-1/4" size and smaller – 6 ft. intervals
 - b. 1-1/2" thru 2" – 8 ft.. intervals
 - c. 2-1/2" and larger – 10 ft. intervals
 7. Plastic pipe
 - a. Per manufacturer's recommendations.
- B. In piping systems with mechanical joint couplings, pipe hangers shall be provided on horizontal piping at normal specified intervals and, in addition, so that no pipe shall be left unsupported between any two couplings nor left unsupported whenever a change in direction takes place. Vertical piping shall be supported at normal specified intervals or every other pipe length, which ever is more frequent. The base of the riser or base fitting shall be supported.
- C. Attachment of pipe hangers to the structure shall be with:
1. Provide anchoring where steel beam clamps are attached to sloping surfaces of beam flanges and where otherwise required to insure permanent attachment.
 2. Unistrut channels with spring and nut rod connection may be utilized where a number of pipes are run parallel. Channel shall be attached to the structure with inserts or clamps.
 3. Attachment to steel deck is prohibited. Span from steel structural members with supplementary steel shapes where direct attachment to structural members is not practical.
- D. Attachment to manufactured trusses and other engineered structural members and supports shall be done in strict accordance with the structural manufacturer's recommendations. Refer to the architectural and structural drawings for type of engineered structural systems being used. Connections to these structural members shall be made with connection devices and methods approved by the structural manufacturer. Provide additional supports with supplemental steel shapes when spacing between structural members exceeds specified distances.
- E. Pipe hangers shall be adjusted to proper elevation and all hanger rods set in a vertical position before pipe insulation is installed.
- F. Extended legs of pipe riser clamps shall be shortened as needed to maintain concealment of the clamp within the pipe chase. Ensure that adequate support is still maintained.
- G. Hanger assemblies which will remain exposed on completion of the project shall be painted before installation.
- H. Pipe supports manufactured by Advanced Support Products for pipe running across the roof shall be installed in accordance with the manufacturer's instructions and as detailed. Install protective slip sheets of roofing membrane under the bases to satisfy the requirements of both the roofing manufacturer and the support system manufacturer.

END OF SECTION 22 0529

SECTION 22 0530- EQUIPMENT BASES AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Equipment Supports

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- B. Design seismic-restraint equipment support and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

- A. Product Data: For the following:
1. Equipment hangers and supports.
 2. Equipment bases.
 3. Support Curbs.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 CONCRETE BASES

- A. Concrete bases and pads with anchor bolts cast-in-place. Bases shall be formed on all sides and hand troweled to a smooth, dense finish with neatly chamfered corners. Large concrete pads on grade shall be constructed with reinforcing steel or reinforcing roadway mesh.

2.2 STEEL SUPPORTS

- A. Structural steel angles, beams or channels, unistrut type channels or pipe. Supports shall be fabricated into a rigid framework with welded or bolted connections and cross-bracing or sway bracing. Supports shall be set on slab with base plates, or attached to the building structure as required. Brackets for relatively lightweight equipment may be attached to the wall. Equipment shall be set on and attached to the framework.
- B. Solid steel hanger rods supported from the structure above similar to pipe hangers. Provide sway bracing for equipment supported in this manner.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- B. Field Welding: Comply with AWS D1.1.
- C. Concrete bases for plumbing equipment are included in the Plumbing Contract. The Plumbing Contractor shall provide exact dimensions, locations and other detail for the specific equipment provided. The Plumbing Contractor shall set anchor bolts as required for the equipment.

END OF SECTION 22 0530

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Warning markers.
4. Valve tags.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTAL

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Labels, tags and markers shall comply with ANSI A13.1 for lettering size, colors and length of color field.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Each item or major equipment shall be labeled. This shall include water heaters, pumps and other similar equipment consistent with tags on drawings.
- B. Labeling shall be:
1. Permanently attached engraved brass or plastic laminated signs with 1" high lettering. Signs on exterior equipment shall be brass.
 2. Stencil painted identification, 2" high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel.

2.2 PIPE LABELS

- A. Pipe markings shall be applied to all piping.
- B. Labeling shall be:
 - 1. Snap-On Type – Plastic, semi-rigid snap-on type, manufacturer’s standard pre-printed pipe markers or pressure-sensitive vinyl pipe markers.
 - 2. Adhesive Type – Strip-type markers fastened to the bare pipe or insulation with laminated or bonded application or plastic tape not less than 1-1/2” wide. On piping and insulation 6” and greater diameter provide full band.
 - 3. Lettering heights shall be as specified by manufacturer for indicated pipe/pipe plus insulation size.
 - 4. Markers shall extend fully around pipe and insulation or full circle at both ends of the marker.
 - 5. Markers shall be color coded for service.
 - 6. Flow direction arrows provided integral with the pipe marker or separate at each marker.
 - 7. Service pressure for compressed air and natural gas piping systems.
 - 8. In areas where exposure to water or high humidity is anticipated, provide washdown, fade-resistant style labels.

2.3 WARNING MARKERS

- A. Underground line marker tape shall be permanent, bright-colored, plastic with continuous identification lettering. Tape over service lines that cannot be detected by a metal detector shall be multi-ply with an aluminum foil core.

2.4 VALVE TAGS

- A. Each shutoff valve, other than at equipment, shall be identified with a stamped tag. Valves and tagging shall be scheduled, typewritten on 8-1/2” x 11” paper, tabulating valve number, piping system, abbreviation, location of valve (room or area) and service (e.g. – south wing reheat boxes).
- B. Valve tags shall be polished brass or plastic laminate with solid brass S hook. Tags shall be engraved with “P” for Plumbing and the designated number.

2.5 ACCEPTABLE MANUFACTURERS

- A. Labels, markings and tags shall be manufactured by:
 - 1. W.H. Brady
 - 2. Seton

3. Allen
4. Industrial Safety Supply
5. McMaster-Carr

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification marking and tagging shall be applied after insulation and painting has been completed.
- B. Coordinate names, abbreviations and other designations used in plumbing identification work, with corresponding designations shown, specified, or scheduled on drawings.
- C. The Plumbing, Fire Suppression and HVAC Contractors shall coordinate labeling, marking and tagging to attain coordinated and consistent systems of identification.
- D. Equipment labeling shall consist of unit designation as shown on the drawings.
- E. Pipe markers shall be placed at 25 ft. centers in mechanical rooms and concealed spaces and at 50 ft. centers in other exposed locations.
- F. Refer to appropriate sections of this specification for installation of underground line marker tape.
- G. Service pressure markings to be placed upstream and downstream of regulators at each pipe service label.
- H. Valve tags shall be placed on each valve except those intended for isolation of individual items of equipment. Valve tag schedules shall be prepared as specified above.

END OF SECTION 22 0553

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SECTION 22 0719 - PIPE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Fiberglass.
 - b. Flexible Elastomeric.
2. Protective Jacketing

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

A. Product Data:

1. For each type of product indicated.
2. Thickness and covering table.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Thicknesses shall be in compliance with ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 INSULATION GENERAL

- A. Refer to insulation schedule on the Drawings for piping material and applications.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be done by tradesmen specializing in insulation work in strict accordance with the manufacturer's recommendations.
- B. Overlap and seal all longitudinal joints. Staples and adhesive may be used as stated above. Tape and seal cross joints. Vapor barrier shall be continuous on insulation of all cold services. Vapor barrier type mastic shall be used where needed to maintain a vapor seal.
- C. Where insulation is terminated, insulation shall be beveled at 45 degrees and the beveled surface sealed with vapor barrier mastic. PVC caps over straight cut ends which have been vapor sealed may be used in lieu of beveling.
- D. Mechanical joint fittings and couplings shall be considered as a part of the pipeline and shall be insulated. Bidders on the insulation work are cautioned to verify during the bidding period the extent of this work.
- E. Insulation on cold service piping shall be run through floor and wall sleeves to maintain vapor barrier continuity. Insulation on other services may likewise be run continuous when sleeve size permits. Refer to Section 22 0529 for non-compressible insulation or blocking material and sheet metal saddles required at pipe hangers. Coordinate with the contractor on the furnishing, installation and detailed requirements of these. Provide insulation and vapor barrier on and around supports for pipe risers of services which require vapor seal so as to prevent sweating.
- F. Re-insulate piping where existing insulation has been damaged or removed in the performance of work in this project.
- G. Verify that piping has been tested before applying insulation materials and that piping surfaces are clean and dry, with foreign material removed.

- H. Fittings, valves, flanges and other devices, both exposed and concealed, requiring insulation shall be covered same thickness as pipe insulation with:
1. Factory molded fitting insulation cover with PVC one-piece fitting cover.
 2. Miter-cut segments of pipe insulation, held in place with adhesive and/or wire, filled with insulating cement smoothed to shape and covered with PVC one-piece fitting cover.
 3. Fiberglass blanket insulation, held in place and covered with PVC one-piece fitting cover.
 4. Oversized pipe insulation, where applicable, finished same as straight run pipe insulation.

END OF SECTION 22 0719

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SECTION 22 800 – PLUMBING COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

- A. The Owner has contracted separately with a Commissioning Agent independent from the Architect, Engineer and Contractors. The Commissioning Agent shall be responsible solely to the Owner and shall act as an agent to the Owner in reviewing the quality of the project. The Commissioning Agent shall, through the Owner, have the authority to direct the Contractors to perform corrective work until final acceptance of the project by the Owner.
- B. The purpose of the commissioning is to verify that the building systems have been designed and installed to meet the Owner's requirements and operate per the design intent. Commissioning does not eliminate or reduce the contractor's responsibility to provide a complete and functional systems.
- C. The Plumbing contractor shall participate in the commissioning process and provide adequate personnel to do so.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 RELATED DOCUMENTS

- A. Section 01 9113 – General Commissioning Requirements

1.4 PLUMBING SYSTEMS / EQUIPMENT INCLUDED IN THE COMMISSIONING PROCESS

- A. The following Plumbing Systems shall be commissioned.
 - 1. Water Heating
 - 2. Mixing Valve
 - 3. Return water balancing

PART 2 - COMMISSIONING PLAN

2.1 PRE-FUNCTIONAL TESTING / START UP

- A. The Commissioning Agent will provide pre-functional checklists. The installing contractor will complete the pre-functional checklist and the Manufacturer's start-up checklist for each piece of equipment prior to functional testing.

- B. Startup of major Plumbing equipment will be witnessed by the Commissioning Agent. The contractor shall provide a minimum of 72 hours' notice to the Commissioning Agent prior to equipment start up. The appropriate contractors and or manufacturer's representative will be required to be on site to perform start up.

2.2 TAB MONITORING

- A. A Testing And Balancing (TAB) report approved by the engineer will be required before functional testing begins. The Commissioning Agent will periodically review the TAB procedures and randomly test measurements.
- B. The TAB contractor shall be available to the Commissioning Agent for a minimum of 8 hours to assist with the spot checks of each system after balancing is complete. The spot checks will include both air and water balancing. The TAB contractor shall use the same instruments for spot checking as were used for the balancing.

2.3 FUNCTIONAL TESTING

- A. The Commissioning Agent will perform or witness the installing contractor or manufacturer's representative performing functional testing.

2.4 ISSUE LOG

- A. All deficiencies noted during the commissioning process will be documented in the master issues log.
- B. Contractors shall be responsible for correcting deficiencies and providing written responses to the Commissioning Agent listing the date and resolution. If a deficiency is not corrected the contractor shall provide an explanation as to why it was not corrected.
- C. Participation in the commissioning process is the contractor's responsibility. Unresolved issues or failure to provide responses to the Issue Log may be considered during the pay application approval process.
- D. The status of all items on the issue log will be updated and tracked by the Commissioning Agent.
- E. The Commissioning Agent will perform limited rechecks of items on the issues log after the contractor has provided written confirmation that corrections are complete. The cost of subsequent rechecks, if necessary, will be charged directly to the appropriate contractor at the hourly rate of the Commissioning Agent.

2.5 WARRANTY REVIEW

- A. The Commissioning Agent will return to the site approximately one month prior to the end of the warranty period to review outstanding issues and review system operation. The Commissioning Agent will assist the facility staff in developing reports and requests for services to remedy outstanding problems.

PART 3 - EXECUTION

3.1 RESPONSIBILITY OF THE PLUMBING CONTRACTOR

- A. The contractor shall provide the Commissioning Agent assistance as necessary to gain access to the construction site for the purpose of verifying the installation of equipment and materials is performed in accordance with the contract documents. This shall include the use of keys, ladders, power lifts and other specialized equipment where needed.
- B. Assure participation of major equipment manufacturers in appropriate start up, training, and testing activities.
- C. Participate in commissioning meetings scheduled by the Commissioning Agent or the Construction Manager.
- D. Complete pre-functional checklists for review by the Commissioning Agent.
- E. Assist the Commissioning Agent as needed during the functional testing.
- F. Participate in seasonal testing as required.
- G. Provide owner training per the project specifications
- H. The contractor shall submit to the Commissioning Agent the following information for all facility equipment and materials. This information will be used to create the facility maintenance plan.
 - 1. Manufacturer
 - 2. Supplier
 - 3. Model
 - 4. Serial Number
 - 5. Replacement Cost
 - 6. Warranty Start Date
 - 7. Warranty Duration
 - 8. Belt Sizes and Quantities (if applicable)
 - 9. Filter Sizes and Quantities (if applicable)
- I. It is the responsibility of each contractor to complete all equipment setup, testing, calibration, loop tuning, and related functions prior to commissioning. The contractor shall complete all the required checklists and certify in writing that these tasks have been accomplished on the systems are ready for commissioning.

END OF SECTION 22 0800

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SECTION 22 1116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Valves Schedules
3. Unions and Flanges.
4. Dielectric Connectors.
5. Pipe Sleeves
6. Escutcheons.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product used.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIAL

- A. Refer to piping and valve schedules on the Drawings for piping materials, valves, and applications.

2.2 UNIONS AND FLANGES

- A. Unions on copper tubing, all bronze construction 150 lb., solder ends.
- B. Unions on steel pipe 2" and smaller, malleable iron with ground seat, bronze to steel, 300 lbs., screwed ends.
- C. Flanges on steel pipe with welded or screwed joints, 2-1/2" and larger. Gaskets shall be 1/16" thickness full face compressed sheet suitable for temperature and pressure ranges of the application.
- D. Mechanical joints associated with grooved end pipe are acceptable in lieu of unions and flanges.

2.3 DIELECTRIC FITTINGS

- A. Refer to Division 22 Section "Common Piping Materials and Methods" for dielectric fitting requirements.

2.4 PIPE SLEEVES

- A. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Refer to Division 22 Section "Common Piping Materials and Methods" for basic piping installation requirements.
- B. Piping shall be pitched for drainage. The low points shall be fitted with a 3/4" drain valve (with hose thread adapter if not piped to a floor drain) except that on piping 1-1/4" and smaller where a drain valve is not shown, a drain plug is acceptable. Hose thread adapters on drain valves of
- C. Piping shall be installed consistent with good piping practice and run concealed wherever possible. Coordinate with other trades to attain a workmanlike installation.
- D. Piping shall be supported as specified in Section 22 0529 Pipe Hangers. Piping with mechanical joints for grooved end steel pipe shall be supported in accordance with the manufacturer's recommendations. Pipe alignment in both the horizontal and vertical must be tightly maintained. Misalignment must be corrected to the satisfaction of the Engineer before insulation is applied and the system accepted.
- E. Inform the Insulation sub-contractor during the bid period as to the extent of use of mechanical joints so that sub-contractor can price the work accurately.
- F. Internals of sweat end valves shall be removed when damage or warping could occur due to applied heat of soldering. Where silver brazing is specified, solder connection of valves shall be

used to reduce the danger of damage. Close open ends of piping during installation to keep interior of the pipe clean.

- G. Install strainers as indicated on the drawings. Provide a nipple and ball valve in the blow down connection of each strainer 2" and larger.
- H. Unions and flanges shall be installed at pipe connections to fixtures and equipment and as required for erection purposed.
- I. Refer to Division 22 Section "Common Piping Materials and Methods" for dielectric fitting requirements.
- J. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.
- K. Refer to Division 22 Section "Pipe Hangers and Supports" for basic hanger and support requirements
- L. Refer to Division 22 Section "Common Piping Materials and Methods" for escutcheon requirements.
- M. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for equipment and piping labeling requirements.

3.2 FIELD QUALITY CONTROL

A. Piping Inspections:

- 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
- 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Piping Tests:

- 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. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 4. Domestic water piping – hydrostatic at 125 psig for 6 hours at the low point of the system. Leaks and loss in test pressure constitute defects that must be repaired.
 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 6. Prepare reports for tests and for corrective action required.
- C. Domestic water piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.3 PIPE CLEANING

- A. Before placing each water piping system in operation, the piping system shall be thoroughly flushed out with clean water.

3.4 DISINFECTION OF PIPING

- A. All new domestic water piping shall be disinfected by a company or personnel regularly engaged in the performance of this service.
- B. Fire suppression water piping supplied from a potable water system shall also be disinfected if the potable water systems, both public and private, is not protected by a double check valve assembly or reduced pressure backflow assembly.
- C. Disinfection shall be performed in accordance with AWWA C651- 86 Standards. Disinfection shall be means of a chlorine solution injected into the water system near the source. Outlets throughout the system shall be tested to prove presence of minimum chlorine concentration. Flush out the system with clean water until the residual chlorine content is not greater than .2 parts per million or until approved by the Health Department.
- D. Disinfection procedures shall be witnessed by the Architect, Engineer or other qualified representative.

END OF SECTION 22 1116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Temperature-actuated water mixing valves.
 - 2. Water hammer arresters.
- B. See Division 22 Section "Domestic Water Piping" for water meters.
- C. See Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.
- D. See Division 22 Section "Domestic Water Filtration Equipment" for water filters in domestic water piping.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

- A. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Master Thermostatic Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lawler Manufacturing Company, Inc.
 - b. Leonard Valve Company.
 - c. Powers; a Watts Industries Co.
 - d. Symmons Industries, Inc.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 120 deg F .
9. Valve Finish: Rough bronze.
10. Piping Finish: Copper.

B. Emergency Fixture Thermostatic Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Guardian Equipment
 - b. Bradley Corporation
 - c. Lawler Manufacturing Company, Inc.
 - d. Leonard Valve Company.
 - e. Powers; a Watts Industries Co.
 - f. Symmons Industries, Inc.
2. Standard: ASSE 1071.
3. Pressure Rating: 125 psig.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Union inlets and outlet.
6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, thermometer on outlet, temperature-control handle.
7. Tempered-Water Setting: 85 deg F.
8. Tempered-Water Design Flow Rate: 20 gpm(showers)/.4gpm(eyewash).
9. Valve Finish: Rough bronze.
10. Piping Finish: Copper.

C. Point of Use Thermostatic Mixing Valves:

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lawler Manufacturing Company, Inc.
 - b. Leonard Valve Company.
 - c. Powers; a Watts Industries Co.
 - d. Symmons Industries, Inc.
2. Standard: ASSE 1070.
3. Pressure Rating: 125 psig.
4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, thermometer on outlet, temperature-control handle.
8. Tempered-Water Setting: 105 deg F.
9. Tempered-Water Design Flow Rate: 0.5 gpm minimum.
10. Valve Finish: Chrome plated.
11. Piping Finish: Copper.

2.2 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves.

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: 3/4".
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.3 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.

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- i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- 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.
 1. Install thermometers and water regulators if specified.
 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- D. Install water hammer arresters on each quick closing valve in water piping according to PDI-WH 201.
- E. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- F. 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 Division 22 Section "Identification for Plumbing Piping and Equipment."

3.2 FIELD QUALITY CONTROL

- A. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

- A. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 22 1119

SECTION 221123 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic hot-water recirculation:
 - 1. Close-coupled, in-line, seal less centrifugal pumps.
- B. See Division 22 Section "Domestic-Water Packaged Booster Pumps" for booster systems.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.
- B. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: 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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 CLOSE-COUPLED, IN-LINE, SEALLESS CENTRIFUGAL PUMPS

- A. Description: Factory-assembled and -tested, single-stage, close-coupled, in-line, seal-less centrifugal pumps as defined in HI 5.1-5.6.
 - 1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge-type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.

2. Casing: Bronze, with threaded companion-flange connections.
3. Impeller: Corrosion-resistant material.
4. Motor: Single speed, unless otherwise indicated. Comply with requirements in Division 22 Section "Electrical Requirements for Plumbing Equipment."

B. Capacities and Characteristics:

1. Capacity: Refer to Drawings.r
2. Total Dynamic Head: Refer to Drawing for
3. Maximum Operating Pressure: 125 psig.
4. Maximum Continuous Operating Temperature: 220 deg F .
5. Inlet and Outlet Size: Refer to Drawings
6. Motor Horsepower: Refer to Drawings
7. Electrical Characteristics: Refer to Drawings

C. Acceptable Manufacturers:

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Industries.
3. Grundfos Pumps Corp.
4. Taco, Inc.

2.2 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion sensor, for installation in hot-water circulation piping.
2. Range: 65 to 200 deg F.
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 120 V, ac.
6. Settings: Start pump at 110 deg F and stop pump at 120 deg F.
7. Acceptable Manufacturers:
 - a. Honeywell International, Inc.
 - b. Square D.
 - c. White-Rodgers Div.; Emerson Electric Co.

B. Timers: pump timing to be controlled thru the building automation system.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Install in-line, seal-less centrifugal pumps with motor and pump shafts horizontal.
- E. Install continuous-thread hanger rods and spring hangers of sufficient size to support pump weight. Fabricate brackets or supports as required. Hanger and support materials are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- F. Coordinate with H.C. to connect. pump to building automation system for pump timing.
- G. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- H. Install piping adjacent to pumps to allow service and maintenance.
- I. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 22 Section "Domestic Water Piping."
 - 1. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves for domestic water piping and Division 22 Section "Domestic Water Piping Specialties" for strainers.
 - 2. Install test plugs for pressure gage at suction and discharge of pumps. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and test plugs.
 - 3. Install thermometer at suction of pumps. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometer.
- J. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

END OF SECTION 22 1123

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SECTION 22 1316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

3. RELATED REQUIREMENTS

- a. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.2 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.

1.3 SUBMITTALS

- A. Product Data: For each type of product used.
- B. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Cast iron pipe, fittings, and standard duty no-hub couplings shall be listed by NSF International and marked with "NSF" demonstrating certification.
- C. Plastic piping and components shall comply with NSF 14, "Plastics Piping Systems Components and Related Materials,". Include marking with "NSF-DWV" for plastic drain, waste, and vent piping; and "NSF-drain" for plastic drain piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to piping schedule on the Drawings for piping material and applications.

PART 3 - EXECUTION

3.1 PIPING INSTALLATIONS

- A. Basic piping installation requirements are specified in Division 22 Section ""Common Piping Materials and Methods. "
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section " Common Piping Materials and Methods."
- D. 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."
- E. On piping 5" and larger provide bracing at every branch opening or change in direction as required by CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- F. Piping suspended 18" or more shall be provided with sway bracing as required by CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- G. Use long-turn, double Y-branch and 1/8-bend fittings if 2 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.
- H. 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.
- I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow for piping smaller than 3" and; 1 percent downward in direction of flow for piping 3" and larger.
 2. Vent Piping: slope down toward vertical fixture vent or toward vent stack.
- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- K. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- L. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- M. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.
- N. Refer to Division 22 Section "Pipe Hangers and Supports" for basic hanger and support requirements
- O. Refer to Division 22 Section "Common Piping Materials and Methods" for escutcheon requirements.
- P. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for equipment and piping labeling requirements.

3.2 JOINT CONSTRUCTION

- A. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- B. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.3 CONNECTIONS

- A. Connect soil and waste piping to existing sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code or indicated on the drawings.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections 2-1/2" and larger.

3.4 FIELD QUALITY CONTROL

- A. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.
 - 1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 2. Prepare reports for tests and required corrective action.

3.5 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Plug the ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 1316

SECTION 22 1317 – ACID WASTE SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-wall piping.
2. Piping specialties.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 PERFORMANCE REQUIREMENTS

- A. Single-Wall Piping Pressure Rating: 10 feet head of water.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For chemical-waste specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to piping schedule on the Drawings for piping material and applications.
- B. Adapters and Transition Fittings: Assemblies with combination of clamps, couplings, adapters, and gaskets; compatible with piping and system liquid; made for joining different piping materials.

2.2 JOINING MATERIALS

- A. Couplings: Assemblies with combination of clamps, gaskets, sleeves, and threaded or flanged parts; compatible with piping and system liquid; and made by piping manufacturer for joining system piping.
- B. Adapters and Transition Fittings: Assemblies with combination of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with piping and system liquid; and made for joining different piping materials.

2.3 PIPING SPECIALTIES

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Piping Materials and Methods."
- B. Set floor drains with tops flush with finished surface.
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select the number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Piping Materials and Methods."
- D. 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."
- E. Piping suspended 18" or more shall be provided with sway bracing as required by CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- F. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back-to-back or side by side with common drainpipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use the proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing the size of drainage piping in direction of flow is prohibited.
- G. 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.
- H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

- I. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow for piping smaller than 3" and; 1 percent downward in direction of flow for piping 3" and larger.
- J. Vent Piping: slope down toward vertical fixture vent or toward vent stack.
- K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- L. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing the size of piping in direction of flow is prohibited.
- M. Install PE drainage piping according to ASTM D 2321 and ASTM F 1668.
- N. Install PVC drainage piping according to ASTM D 2321 and ASTM F 1668.
- O. Install PVDF drainage piping according to ASTM D 2321 and ASTM F 1668.
- P. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.
- Q. Refer to Division 22 Section "Pipe Hangers and Supports" for basic hanger and support requirements.
- R. Refer to Division 22 Section "Common Piping Materials and Methods" for escutcheon requirements.
- S. Install drainage piping outside the building with 36-inch minimum cover.
- T. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for equipment and piping labeling requirements.

3.2 JOINT CONSTRUCTION

- A. Chemical-Waste Piping Inside the Building:
 - 1. Plastic-Piping Electrofusion Joints: Make polyolefin drainage-piping joints according to ASTM F 1290.
 - 2. Dissimilar-Material Piping Joints: Make joints using adapters compatible with both system materials.

3.3 CONNECTIONS

- A. Make connections to existing piping so finished Work complies as nearly as practical with requirements specified for new Work.
- B. Use commercially manufactured wye fittings for sewerage 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 .

- C. Protect existing piping to prevent concrete or debris from entering while making connections. Remove debris or other extraneous material that may accumulate.
- D. Install piping adjacent to equipment to allow service and maintenance.

3.4 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in the presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test acid waste and vent piping according to procedures of authorities having jurisdiction.
 - 1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 2. Prepare reports for tests and required corrective action.

3.5 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during the remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Plug the ends of uncompleted piping at end of day and when work stops.
- D. Use procedures prescribed by authorities having jurisdiction or, if not prescribed, use procedures described below:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Clean piping by flushing with potable water.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain leak-detection systems.

END OF SECTION 22 1371

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Miscellaneous sanitary drainage piping specialties.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

- A. Floor drains shall be as indicated on the drawings:

2.2 CLEANOUTS

- A. Cast-Iron Floor Cleanouts shall be as indicated on the drawings
- B. Cast-Iron Wall Cleanouts
 - 1. Manufacturer shall be same as floor drains.
 - 2. Standard: ASME A112.36.2M. Include wall access.
 - 3. Size: Same as connected drainage piping.
 - 4. Body: as required to match connected piping.

C. Floor-Drain, Trap-Seal Maintenance Device:

1. Description: Device inserted into the drain body or adjustable strainer that opens to allow water to pass thru and closes to prevent sewer gases from entering the room from the drainage system.
2. Must conform to ASSE 1072 .
3. Size: Same as floor drain outlet.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to 4". Use 4" for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 100 feet.
 4. Locate at base of each vertical soil and waste stack.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

- 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- G. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- H. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 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 221319

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SECTION 221416 - INTERIOR STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following storm drainage piping inside the building.
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Storm Drainage Piping: 10-foot head of water.

1.4 SUBMITTALS

- A. Product Data: For each type of product used.
- B. Field quality-control inspection and test reports.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to piping schedule on the Drawings for piping material and applications.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section ""Common Piping Materials and Methods. "
- B. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Storm Drainage Piping Specialties."
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section " Common Piping Materials and Methods."
- D. 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."
- E. On piping 5" and larger provide bracing at every branch opening or change in direction as required by CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- F. Piping suspended 18" or more shall be provided with sway bracing as required by CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- G. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. 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.
- H. Lay buried building drain 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.
- I. Install storm drainage piping at the following minimum slopes, 1/4" per linear foot downward in direction of flow for piping 2 1/2" and smaller; 1/8" per linear foot downward in direction of flow for piping 3" and larger.
- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- K. Install PVC storm drainage piping according to ASTM D 2665.
- L. Install underground PVC storm drainage piping according to ASTM D 2321.
- M. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.

- N. Refer to Division 22 Section "Pipe Hangers and Supports" for basic hanger and support requirements
- O. Refer to Division 22 Section "Common Piping Materials and Methods" for escutcheon requirements.
- P. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for equipment and piping labeling requirements.
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.2 JOINT CONSTRUCTION

- A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.3 CONNECTIONS

- A. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect storm drainage piping to roof drains and storm drainage specialties.

3.4 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 1. Test storm drainage piping according to procedures of authorities having jurisdiction. Maintain record of tests.

3.5 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Plug the ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 1416

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following storm drainage piping specialties:

1. Cleanouts.
2. Roof drains.
3. Miscellaneous storm drainage piping specialties.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 ROOF DRAINS

- A. Cast-Iron Roof Drains:

1. Standard: ASME A112.21.2M.
2. Pattern: Roof drain.
3. Body Material: Cast iron.
4. Combination Flashing Ring and Gravel Stop: Required.
5. Outlet: Bottom.
6. Dome Material: Cast iron.
7. Underdeck Clamp: Required.
8. Sump Receiver: Required.
9. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.

- b. MIFAB, Inc.
- c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- d. Tyler Pipe; Wade Div.
- e. Watts Drainage Products Inc.
- f. Zurn Plumbing Products Group; Specification Drainage Operation.

2.2 CLEANOUTS

A. Floor Cleanouts:

- 1. Manufacturer shall be same as floor drains.
- 2. Standard: ASME A112.36.2M for adjustable housing cast-iron soil pipe with cast-iron ferrule threaded, adjustable housing cleanout.
- 3. Size: Same as connected branch.
- 4. Type: Heavy-duty, adjustable housing.
- 5. Body or Ferrule: PVC.
- 6. Clamping Device: Not required.
- 7. Outlet Connection: Threaded.
- 8. Closure: Plastic plug.
- 9. Adjustable Housing Material: PVC with threads.
- 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
- 11. Frame and Cover Shape: Round.
- 12. Top Loading Classification: Extra Heavy Duty.
- 13. Riser: Same as DWV piping.

B. Cast-Iron Wall Cleanouts

- 1. Manufacturer shall be same as floor drains.
- 2. Standard: ASME A112.36.2M. Include wall access.
- 3. Size: Same as connected drainage piping.
- 4. Body: Same as DWV piping.
- 5. Closure: Countersunk, drilled-and-threaded brass plug.
- 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- 7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to 4". Use 4" for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet.
 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roof materials are specified in Division 07.
1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 2. Position roof drains for easy access and maintenance.
- F. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- G. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
- H. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 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 1423

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SECTION 22 1513 - GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes piping and related specialties for general-service compressed-air systems operating at 150 psig or less.
- B. See Division 22 Section "General-Service Air Compressors and Receivers" for general-service air compressors and accessories.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product used.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Refer to piping and valve schedules on the Drawings for piping materials, valves, and applications.

2.2 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.
 - 1. ASME B16.21, non-metallic, flat, full-face, asbestos free, 1/8-inch maximum thickness.

- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

2.3 DIELECTRIC FITTINGS

- A. General Requirements for Dielectric Fittings: Combination of copper alloy and ferrous materials with insulating material; suitable for system fluid, pressure, and temperature. Include threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Dielectric Unions: Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

2.4 FLEXIBLE PIPE CONNECTORS

- A. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: 200 psig minimum.
 - 2. End Connections, NPS 2" and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections, NPS 2-1/2" and Larger: Flanged copper alloy.
- B. 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 minimum.
 - 2. End Connections, NPS 2" and Smaller: Threaded steel pipe nipple.
 - 3. End Connections, NPS 2-1/2" and Larger: Flanged steel nipple.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.6 ESCUTCHEONS

- A. General Requirements: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.
- B. One-Piece, Cast-Brass Escutcheons: With set screw.
 - 1. Finish: Polished chrome-plated brass.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- 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. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
- E. Install piping adjacent to equipment and machines to allow service and maintenance.
- F. Install air and drain piping with a 1 percent slope downward in direction of flow.
- G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.
- H. 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.
- I. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping."
- J. Install piping to permit valve servicing.
- K. Install piping free of sags and bends.
- L. Install fittings for changes in direction and branch connections.
- M. Install unions, adjacent to each valve and at final connection to each piece of equipment and machine.

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Apply appropriate tape or thread compound to external pipe threads.

- D. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
- G. Solvent-Cemented Joints for PVC Piping: Clean and dry joining surfaces. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer and join according to ASME B31.9 for solvent-cemented joints and to ASTM D 2672.
- H. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.3 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping."

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric unions in piping at connections of dissimilar metal piping and tubing.

3.5 FLEXIBLE PIPE CONNECTOR INSTALLATION

- A. Install flexible pipe connectors in discharge piping of each air compressor.

3.6 SLEEVE INSTALLATION

- A. Install sleeves for pipes passing through concrete and masonry walls, gypsum board partitions, and concrete floor and roof slabs using galvanized-steel pipe. Comply with requirements in Division 22 Section "Common Piping Materials and Methods."

3.7 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors according to the following: Comply with requirements in Division 22 Section "Common Piping Materials and Methods."

3.8 HANGER AND SUPPORT INSTALLATION

- A. Install hangers and supports for general-service compressed-air piping, valves, and specialties. Comply with requirements in Division 22 Section "Pipe Hangers and Supports."

3.9 LABELING AND IDENTIFICATION

- A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.10 FIELD QUALITY CONTROL

- A. Perform field tests and inspections.
- B. Tests and Inspections:
 - 1. Piping Leak Tests: 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 above system operating pressure, but not less than 200 psig. 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.

END OF SECTION 22 1513

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SECTION 22 1613 – NATURAL GAS HOUSE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
- B. All gas piping work shall be in accordance with Gas Company requirements. Verify materials selected are in conformance before installation.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Welding certificates.
- C. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Materials and installation shall conform to the standards and requirements of the Gas Company and the Ohio Building Code including the referenced International Fuel Gas Code.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to piping schedule on the Drawings for piping material and applications.

2.2 PIPING SPECIALTIES

- A. Gas Pressure Regulators:

1. Gas pressure regulator shall be self-operating spring-loaded type. Valve body shall be cast iron, 125 psi construction with screwed or flanged connections. Spring and diaphragm casings shall be aluminum. Regulator shall have an internal relief valve assembly, tapped vent connection with removable screen on the spring casing and an external pilot operator to afford a 5% maximum droop. Over-pressure protection shall be ten times the inlet pressure (or higher as may be required by the gas company).

- B. Regulator shall be Sensus equal by Fisher, Sprague or Equimeter. Refer to the drawings for capacity, inlet and outlet pressures and installation detail. Transition Fittings:

- C. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Anodeless Service-Line Risers: Factory fabricated and leak tested.

- a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
- b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
- c. Aboveground Portion: PE transition fitting.
- d. Outlet shall be threaded or suitable for welded connection.
- e. Tracer wire connection.
- f. Ultraviolet shield.
- g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2. Transition Service-Line Risers: Factory fabricated and leak tested.

- a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
- b. Outlet shall be threaded or suitable for welded connection.
- c. Bridging sleeve over mechanical coupling.
- d. Factory-connected anode.
- e. Tracer wire connection.
- f. Ultraviolet shield.
- g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Piping Materials and Methods."
- B. Indoor Piping Installation
 - 1. Valves, unions and threaded joints are not permitted in inaccessible locations. Valves shall not be located in air plenums or ducts.
 - 2. Comply with Gas Company for installation and purging of natural-gas piping.
 - 3. A shutoff valve, and dirt and moisture leg with screwed end cap, and a union shall be provided on the pipe drop to each item of equipment.
 - 4. Gas pressure regulators shall be installed in accordance with the manufacturer's instructions. Provide valved gauge taps upstream and downstream of the regulator and a pressure gauge on the downstream side. Provide pilot regulator piping and miscellaneous valves, devices and piping to complete the installation.
 - 5. Vent piping shall be extended individually from each regulator and gas venting device to outside the building in an approved location.
 - 6. Piping installed above ground and outdoors shall be painted to protect it from corrosion.
 - 7. Unions and flanges shall be installed at pipe connections to fixtures and equipment and as required for erection purposes.
 - 8. Refer to Division 22 Section "Common Piping Materials and Methods" for sleeve requirements.
 - 9. Refer to Division 22 Section "Pipe Hangers and Supports" for basic hanger and support requirements
 - 10. Refer to Division 22 Section "Common Piping Materials and Methods" for escutcheon requirements.
 - 11. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for equipment and piping labeling requirements.

3.1 PIPING JOINT CONSTRUCTION

- A. Ream the ends of pipes and tubes and remove burs.
- 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 dyes.
 - 3. Ream threaded pipe ends to remove burs 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:

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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.

3.1 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance.
- B. Install regulator with maintenance space adequate for servicing and testing.

3.2 CONNECTIONS

- A. Connect to utility's gas service 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 of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Dirt Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.3 FIELD QUALITY CONTROL

- A. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction. Test pressure shall be 3 psi or 1.5 times the working pressure whichever is greater.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 22 1613

SECTION 22 3436 –GAS-FIRED STORAGE WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following fuel-fired water heaters:
 - 1. Commercial, power-burner, storage, gas water heaters.
 - 2. Water heater accessories.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.
- D. Warranty.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: 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. ASHRAE/IESNA 90.1-2010 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2010.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section III, Division 1.
- D. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period: From date of Substantial Completion:
 - a. Commercial, Gas Water Heaters: 10 years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS WATER HEATERS

- A. Commercial, Power-Burner, Storage, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.
 - 1. Storage-Tank Construction: Non-ASME-code 444 stainless steel with 150-psig working-pressure rating.
 - a. Tappings: Threaded ends according to ASME B1.20.1 Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank finishes, including extending finish into and through tank fittings and outlets.
 - 2. Factory-Installed, Storage-Tank Appurtenances:
 - a. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - b. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - c. Jacket: Steel with enameled finish.
 - d. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - 3. Burner: Comply with UL 795 for power-burner water heaters and for natural gas fuel.
 - a. Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
 - 4. Temperature Control: Adjustable thermostat.
 - 5. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.

6. Special Requirements: NSF 5 construction.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - a. A. O. Smith, Water Products Company American Water Heaters, Inc.
 - b. Lochinvar, Inc.
 - c. American Water Heaters.

2.2 WATER HEATER ACCESSORIES

- A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.
- B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.
- C. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.
- D. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
- E. Drain Pans: Corrosion-resistant metal with raised edge. Provide dimensions not less than base of water heater and include drain outlet not less than 3/4".
- F. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1-2004.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.
- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install gas water heaters according to NFPA 54.
 - 1. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.
 - 2. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 - 3. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.
- D. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial, water-heater,

relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

- E. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains.
- F. Install thermometer on outlet piping of water heaters.
- G. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- H. Fill water heaters with water.

3.2 CONNECTIONS

- A. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace water heaters that do not pass tests and inspections, and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 3436

SECTION 22 4200 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Faucets for lavatories, showers, and/ sinks.
 - 2. Flushometers.
 - 3. Drinking Fountains
 - 4. Toilet seats.
 - 5. Fixture supports.
 - 6. Water closets.
 - 7. Urinals.
 - 8. Lavatories.
 - 9. Individual showers.
 - 10. Kitchen sinks.
 - 11. Service sinks.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. FRP: Fiberglass-reinforced plastic.
- C. PVC: Polyvinyl chloride plastic.
- D. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: 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. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities and Public Law 101-336, "Americans with Disabilities Act" for plumbing fixtures for people with disabilities and Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- E. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Plastic Laundry Trays: ANSI Z124.6.
 - 2. Plastic Shower Enclosures: ANSI Z124.2.
 - 3. Plastic Sinks: ANSI Z124.6.
 - 4. Stainless-Steel Residential Sinks: ASME A112.19.3.
 - 5. Vitreous-China Fixtures: ASME A112.19.2M.
 - 6. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- F. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 - 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: SME A112.18.3M.
 - 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 - 4. Faucets: ASME A112.18.1.
 - 5. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 6. Hose-Coupling Threads: ASME B1.20.7.
 - 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 8. NSF Potable-Water Materials: NSF 61.
 - 9. Pipe Threads: ASME B1.20.1.
 - 10. Supply Fittings: ASME A112.18.1.
 - 11. Brass Waste Fittings: ASME A112.18.2.
- G. Comply with the following applicable standards and other requirements specified for shower valves:
 - 1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
 - 2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
 - 3. Faucets: ASME A112.18.1.
 - 4. Hand-Held Showers: ASSE 1014.
 - 5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.

6. Hose-Coupling Threads: ASME B1.20.7.
 7. Manual-Control Antiscald Faucets: ASTM F 444.
 8. Pipe Threads: ASME B1.20.1.
 9. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
 10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 11. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
- H. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
1. Atmospheric Vacuum Breakers: ASSE 1001.
 2. Brass and Copper Supplies: ASME A112.18.1.
 3. Dishwasher Air-Gap Fittings: ASSE 1021.
 4. Manual-Operation Flushometers: ASSE 1037.
 5. Brass Waste Fittings: ASME A112.18.2.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Flexible Water Connectors: ASME A112.18.6.
 2. Hose-Coupling Threads: ASME B1.20.7.
 3. Off-Floor Fixture Supports: ASME A112.6.1M.
 4. Pipe Threads: ASME B1.20.1.
 5. Plastic Toilet Seats: ANSI Z124.5.
 6. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 Fixtures and Trim

- A. Refer to the notes/schedule on the drawings for fixture and associate trim specifications.
- B. All waste and supply trim exposed to view shall be chrome plated brass.
- C. Toilet Seats:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bemis Manufacturing Company.
 - b. Centoco Manufacturing Corp.
 - c. Church Seats.
 - d. Kohler Co.
 - e. Olsonite Corp.
 - f. Beneke Div, Sanderson Plumbing Products, Inc.
 2. Description: Toilet seat for water-closet-type fixture.
 - a. Material: Molded, solid plastic with antimicrobial agent.
 - b. Configuration: Open front without cover.

- c. Size: Elongated.
- d. Hinge Type: self-sustaining check.
- e. Class: Heavy-duty commercial.
- f. Color: White.

2.2 FIXTURE CARRIERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Josam Company.
 - 2. MIFAB Manufacturing Inc.
 - 3. Smith, Jay R. Mfg. Co.
 - 4. Tyler Pipe; Wade Div.
 - 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 - 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Water-Closet Carriers:
 - 1. Description: Combination carrier designed for wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with neoprene gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
- C. Urinal Carriers:
 - 1. Description: Urinal carrier with hanger and bearing plates for wall-mounting, urinal-type fixture. Include rectangular steel uprights with feet.
- D. Lavatory Carriers:
 - 1. Description: Lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include rectangular steel uprights with feet.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install feet and anchor lugs of carriers securely affixed to floor using all bolt holes provided.
- C. Install fixtures level and plumb according to roughing-in drawings.
- D. Attach supplies to supports or substrate within pipe spaces behind fixtures to prevent loose piping fitting piping thru walls. Install -supply stop on each water supply to each fixture

connected to water distribution piping. Install stops in locations where they can be easily reached for operation.

- E. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- F. Install toilet seats on water closets.
- G. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.3 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Adjust flow regulators for proper flow and stream height and adjust water cooler temperature settings for drinking fountains.

3.4 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by the Owner.

END OF SECTION 224200

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SECTION 226313 – GAS AND VACUUM PIPING FOR LABORATORY FACILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Argon piping and specialties designated "liquid argon" operating at 120 psig.
2. Helium piping and specialties designated "helium" operating at 100 psig.
3. Argon piping and specialties designated "argon" operating at 30 psig
4. Nitrogen piping and specialties designated "nitrogen" operating at 120 psig.
5. Vacuum piping and specialties operating at 19" hg.

1.2 RELATED REQUIREMENTS

A. Refer to the City of Dayton General Provisions and Supplemental Specification for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Gas manifolds.
2. Piping materials and piping specialties

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Qualification Data: For Installer.

D. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 Refer to piping and valve schedules on the Drawings for piping materials, valves, and applications.

2.2 Pressure Regulators: Stainless-steel body and trim; spring-loaded, diaphragm-operated, relieving type; manual pressure-setting adjustment; rated for 250-psig minimum inlet pressure;

and capable of controlling delivered gas pressure within 0.5 psig for each 10-psig inlet pressure.

2.3 GAS MANIFOLDS

A. Gas Manifolds: Comply with CGA for high-pressure gas cylinders.

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. Airgas Corporation.
 - b. Western Enterprises.
 - c. Harris Products Group
2. Gas Manifold: Where indicated on the drawings provide bottled gas manifold system wall mounted lifeline automatic switchover manifold. Each manifold shall accommodate 2 cylinders divided into two (2) banks for gas service. The cylinder banks provide an uninterrupted supply of gas for the specific gas application. The manifold is cleaned, tested, and prepared for the indicated gas service and constructed in accordance with the requirements of the CGA. The manifold components shall be designed to operate over a temperature range of 32°F through 130°F.
3. Manifold Design and Operation: The manifold operation automatically changes from the depleted primary supply bank to the secondary supply bank without fluctuation in line pressure utilizing dome-bias loading and unloading of the bank regulators. After replacement of the depleted cylinders, the manifold automatically indicates the cylinder bank recently replaced as the secondary supply. Manual resetting of the control panel is not necessary. The manifold includes a line pressure gauge, two (2) cylinder bank pressure gauges (left bank and right bank), and color-coded indicator LED visual indicators for “IN USE” (green), “READY” (yellow), and “EMPTY” (red) for each cylinder bank. The manifold has intermediate and line pressure relief valves that are internally connected to a common vent port, terminating into a one half (1/2) inch FNPT O-ring sealed “zero clearance” union. Master shutoff valves (one for each cylinder bank) are located with the manifold and both valves are fabricated with metallic seating surfaces. The manifold is designed for placement of 2 “H” cylinders directly underneath the manifold cabinet. The cabinet enclosure is removable for component accessibility
4. Manifold Accessories: The manifold accessories shall include high-pressure modular header assemblies with gas specific pigtail-to-header check valves to permit changing of cylinders without gas leakage. Stainless steel flexible pigtails are provided for each cylinder gas connection. A separate power supply is furnished with the manifold to convert 120 VAC to 24 VAC output power and includes dry contacts for two (2) separate, electrically isolated, remote alarm connections. The power supply is housed in a NEMA 3R enclosure with electrical requirements of one (1) amp at 120 VAC, 60Hz, single phase. The manifold is supplied with a one half (1/2) inch FNPT outlet. Provide a main shut-off valve on the discharge immediately after manifold outlet.
5. Label manifold control unit with permanent label identifying medical gas type and system operating pressure.

6. Mounting: Wall with mounting brackets for manifold control cabinet and headers
7. Cylinder mounting: Wall mounted bracket with chains to secure each tank separately.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- B. 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.
- C. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.
- D. Install piping adjacent to equipment and specialties to allow service and maintenance.
- E. Install nipples, unions, and special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications below unless otherwise indicated.
- F. Install piping to permit valve servicing.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Connect gas piping to gas sources and to gas outlets and equipment requiring gas service.
- J. Install unions, in tubing adjacent to each valve and at final connection to each piece of equipment and specialty.
- K. Extend manifold relief valve discharges to outside.

3.2 VALVE INSTALLATION

- A. Install shutoff valve at each connection to gas laboratory and healthcare equipment and specialties.
- B. Install check valves to maintain correct direction of gas flow from laboratory and healthcare gas supplies.
- C. Install pressure regulators on gas piping where reduced pressure is required.

3.3 JOINT CONSTRUCTION

- A. Ream the ends of pipes and remove burs.
- B. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
- C. Threaded Joints: Apply appropriate tape to external pipe threads.

3.4 GAS SERVICE COMPONENT INSTALLATION

- A. Install gas manifolds and cylinder mounting brackets anchored to substrate.
- B. Install and secure gas cylinders and connect to manifold piping.

3.5 Testing

- A. All piping shall be tested at 1-1/2 times the maximum working pressure but not less than 150 psi. Each joint shall be inspected and repaired if necessary. The completely assembled system shall be subjected to a 24- hour standing pressure test 20 percent above the normal operating line pressure. Vacuum systems shall be subjected to a 24-hour standing pressure test at 60 psig with no more than a 5-psig loss. The test gas shall be oil-free, dry air or nitrogen.
- B. Remove and replace components that do not pass tests and inspections, and retest as specified above.

END OF SECTION 22 6313

DIVISION 23 HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)

23 0000 General Requirements for HVAC Systems

- 23 0001 Basic HVAC Requirements
- 23 0002 HVAC Work in Existing Buildings
- 23 0004 Firestopping for HVAC Systems

23 0500 Common Work Results for HVAC

- 23 0513 Electrical Requirements for HVAC Equipment
- 23 0519 Meters and Gauges
- 23 0523 General Duty Valves
- 23 0525 Flexible Pipe Connectors
- 23 0529 Pipe Hangers Supports, & Penetrations
- 23 0530 Equipment Bases and Supports
- 23 0548 Vibration Control
- 23 0553 Identification for HVAC Systems
- 23 0593 Testing, Adjusting and Balancing

23 0700 HVAC Insulation

- 23 0713 Duct Insulation
- 23 0716 Equipment Insulation
- 23 0719 Pipe Insulation

23 0800 Commissioning

- 23 0800 HVAC Commissioning

23 0900 Instrumentation and Control for HVAC

- 23 0913 Instruments and Control Devices
- 23 0914 Control Wiring and Cabling
- 23 0923 Direct Digital Control System
- 23 0950 Variable Frequency Motor Controllers
- 23 0993 Sequence of Operations for Controls

23 2000 HVAC Piping and Pumps

- 23 2113 Hydronic Piping
- 23 2114 Hydronic Specialties
- 23 2117 Glycol Heat Transfer Fluid
- 23 2123 Hydronic Pumps
- 23 2500 HVAC Water Treatment

23 3000 HVAC Air Distribution

- 23 3113 Ductwork
- 23 3119 Plenum Casings
- 23 3300 Air Duct Accessories
- 23 3400 Fans
- 23 3600 Air Terminal Units
- 23 3713 Diffusers, Registers and Grilles
- 23 3723 Gravity Ventilators

23 5000 Central Heating Equipment

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23 5100 Breechings, Chimneys and Stacks
23 5216 Condensing Boilers

23 6000 Central Cooling Equipment

23 6426 Air-Cooled Water Chillers

23 7000 Central HVAC Equipment

23 7313 Modular Indoor Air-Handling Units

23 8000 Decentralized HVAC Equipment

23 8239 Unit Heaters

SECTION 23 0001 – BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes the following:

1. General Requirements
2. Definitions
3. Scope of Work
4. Drawings and Specifications
5. Reference Standards
6. Allowances, Unit Prices and Alternates
7. Site Visit
8. Permits, Regulations and Inspections
9. Project Management and Coordination
10. Temporary Utilities
11. Workmanship
12. Protection
13. Painting
14. Cleaning
15. Miscellaneous Equipment Connections
16. Equipment Selection
17. Shop Drawings
18. Final Inspection and Punch List
19. Operation and Maintenance Manuals
20. Record Drawings
21. Warranties
22. Project Closeout
23. Operation and Adjustment of Equipment
24. Operating Demonstration and Instruction

1.2 GENERAL REQUIREMENTS

- A. All provisions of Division 00 Front End Documents and Division 01 General Requirements apply to work specified in this Division.
- B. Specification provisions of other relevant Divisions shall apply where applicable work is required to be performed under this HVAC work.
- C. A complete and functional HVAC system installation shall be provided under this Division. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

- D. Mechanical and Electrical drawings and specifications assign work (labor and/or materials to be provided by the General, Plumbing, Fire Suppression, HVAC or Electrical Contractor or their sub-contractors. Understanding that the contractors for mechanical and electrical work are sub-contractors to the (General) Contractor, such assignments are not intended to restrict the Contractor in assignment of work among the sub-contractor to accommodate trade agreements and practices or the normal conduct of the construction work.

1.3 BUILD AMERICA, BUY AMERICA ACT REQUIREMENTS

- A. This project will receive Federal funding. Therefore, products and materials procured for the project must comply with the Build America, Buy America Act (BABA). Refer to the City of Dayton General Provisions and Supplemental Specifications for compliance requirements.
- B. The Contractor must maintain a complete list of construction materials, products, and manufacturers' certifications for products used in the project in order to verify (BABA) compliance.

1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, 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.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior 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.

1.5 SCOPE OF WORK

- A. The scope of the HVAC work includes furnishing, installing, testing and warranty of all HVAC work shown on the HVAC drawings and specified herein, including Division 00, Division 01, Division 23 and applicable provisions of other relevant Divisions.

1.6 DRAWINGS AND SPECIFICATIONS

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word "proved," as used, shall mean "furnish and install." If significant deviations

from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect for approval before proceeding with the work.

- B. Make all necessary field measurements to insure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having ductwork, pipe and fittings fabricated and delivered in advance of making actual measurements shall be sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.
- D. The Architect/Engineer shall reserve the right to make minor adjustment in locations of system runs and components where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties.
- E. Equipment, ductwork or piping shall not be installed or run above electrical switchgear or panelboards, nor in or above the access space in the immediate vicinity of the electrical switchgear/panelboards, in accordance with NEC Article 384.
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Architect's decision shall be final in regard to the arrangement of ductwork, piping, etc., where conflict arises.
- G. Provides offsets in system runs, additional fittings, necessary drains and minor valves, traps, dampers and devices required to complete the installation, or for the proper operation of the system. Each Contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

1.7 REFERENCE STANDARDS

- A. Where standards (NFPA, NEC, ADTM, UL, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the authority having jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

1.8 ALLOWANCES, UNIT PRICES AND ALTERNATES

- A. Refer to Sections 012100 Allowances, 012200 Unit Prices and 012300 Alternates.

1.9 SITE VISIT

- A. Refer to Section 017300 Execution.
- B. Each bidder shall visit the project site to understand the existing conditions and compare the conditions with information shown on the drawings. Report immediately to the Architect any issues or discrepancies which are discovered that affect the bid. Changes to contract price will not be considered for site condition issues that are readily apparent from a thorough site review.

1.10 PERMITS, REGULATIONS AND INSPECTION

- A. Regulations – Work must conform to applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawing and specifications shall govern. Install no work contrary to minimum legal standards.
- B. Permit Filing – Except where the permit application is made by the Architect or the Engineer, the HVAC contractor shall be responsible to file for and obtain all required permits from the governing inspection agencies for the HVAC work. Where the Architect or Engineer is the Architect or Engineer of record, they will furnish sealed and signed drawings and specifications required by the permit authorities.
- C. Permit & Inspection Fees – Include payment of all permit and inspection fees applicable to the work in this Division.
- D. Inspection – All work shall be subject to inspection and approval of Federal, State and local agencies as may be appropriate as well as the Architect and Engineer.
- E. Furnish for the Owner certificates of approval from the governing inspection agencies as a condition for final payment.

1.11 PROJECT MANAGEMENT AND COORDINATION

- A. Refer to Section 013100 Project Management and Coordination.
- B. The HVAC Contractor shall initially prepare and be responsible for 1/4" scale coordination drawings. These drawings shall be reproduced and distributed to the Plumbing, Fire Suppression and Electrical Contractors for their input and revisions. Assure that all contractors work together to obtain finish coordinated drawings and no work being installed until all contractors have approved and signed-off with their approval and drawings have been submitted and reviewed by the Engineer.

1.12 TEMPORARY UTILITIES

- A. Refer to Section 015000 – Temporary Facilities and Controls for division of responsibilities for temporary utilities.
- B. The use of the permanent HVAC system for temporary heating and ventilation during the latter stages of construction shall be allowed. Expedite completion of system as practicable to this

end. Maintain the system during this period. Provide and maintain temporary air filters to protect coils and ducts. Replace temporary filters with the specified filters (clean) when the systems are placed on permanent duty. Air filters specified for the systems and units, including specified spare filters, are not to be used for temporary service.

- C. Cover all return duct openings with temporary filter media when recirculating air. Stop fans during heavy dust generating operations. Before turning the system over to the Owner, the Contractor shall clean duct interiors and interior surfaces and components with the air handling equipment if dirt, dust and debris have accumulated on these surfaces.
- D. Warranty periods on equipment, materials and system shall commence upon Owner acceptance of the building or system. Temporary heat use shall not jeopardize or alter the warranty requirements.

1.13 WORKMANSHIP

- A. Refer to Section 014000 Quality Requirements.
- B. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Architect shall have the right to stop the work if highest quality workmanship is not maintained.
- C. HVAC work shall be performed by licensed HVAC Contractors in accordance with requirements of the jurisdiction.

1.14 PROTECTION

- A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect.
- B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide plastic sheeting, drop cloths or similar barriers where dust and debris is generated, to protect adjacent areas.
- C. Contractor shall protect all equipment and materials from detrimental effects of weather or construction activity. All items shall be stored and secured in a protected location away from the daily work area. Equipment or materials shall be placed on raised skids to protect from surface moisture. Where appropriate, provide plastic sheeting or similar vapor barrier underneath the stored products to reduce the effects of ground moisture or curing concrete on the local humidity levels. Where unfinished ferrous products or finished ferrous products with raw edges are stored, provide local, dry heat to maintain ambient relative humidity levels below 65% RH to prevent rust.
- D. All equipment shall retain the original packaging until required to be removed for installation or operation. Open ends of ducts, piping, conduit, etc. shall be capped or sealed and ventilation openings into equipment shall be wrapped and sealed in plastic sheeting to prevent dust or dirt

entry both when stored and after installation but still open to the effects of construction activity. Stored items as well as installed equipment shall be covered with plastic sheeting at all times until placed in service or until dust generating activity in the area has ceased.

1.15 PAINTING

- A. In addition to any painting specified for various individual items of equipment, the following painting shall be included in Division 23:
 - 1. Ferrous metal which is not factory or shop painted or galvanized and which remains exposed to view in the finished areas of the building / building including finished areas, mechanical rooms, storage rooms, and other unfinished areas shall be given a prime coat of paint.
 - 2. Ferrous metal installed outside the building which is not factory or shop painted or galvanized shall be given a prime coat of paint.
 - 3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch-up.
 - 4. Inside of ducts, behind grilles and registers, shall be painted flat black to eliminate the viewing of shiny surfaces.
- B. Paint, surface preparation and application shall conform to applicable portions of the Painting section of Division 09 Finishes. All rust must be removed before application of paint.
- C. Finish painting is included in the General Contract except where otherwise required under remodeling work. Refer to the "Cutting and Patching" paragraph in this Section for finishing requirements.

1.16 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.
- C. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain. The contractor shall also clean duct interiors and interior components of new or existing air handling system equipment if dirt, dust or debris have generated in the course of work have accumulated on these surfaces.

- D. Before placing each system in operation, the equipment shall be thoroughly cleaned; cleaning shall be in accordance with equipment manufacturer's recommendations.
- E. Refer to appropriate Sections for cleaning of other equipment and systems for normal operation.

1.17 MISCELLANEOUS EQUIPMENT CONNECTIONS

- A. Certain categories of fixtures and equipment, including kitchen equipment, sterilizers, washers, laundry and laboratory equipment, require piping connections and duct connections as shown on the drawings. Equipment will be furnished and set in place by the equipment supplier.
- B. Make all final connections to these fixtures and equipment, as indicated and in accordance with the manufacturer's recommendations. All piping connections shall be valved and final connections made with unions.
- C. Supply piping and devices connecting to lab/kitchen equipment, where exposed to view in the finished space, shall be polished welded stainless steel and insulation shall be omitted.
- D. Roughing-in drawings shall be obtained for the various fixtures and items of equipment as the time approaches when such information is required; allow a reasonable period, from the time of notice, to obtain this information.
- E. Connections to equipment shall be in accordance with the manufacturer's installation guidelines. Any additional accessories recommended by the manufacturer such as gauges, shut-off valves, unions at connection points, etc., shall be provided by this Contractor.

1.18 EQUIPMENT SELECTION

- A. Materials and equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.
- B. The selection of materials and equipment to be furnished under this contract shall be governed by the following:
 - 1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specifications, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturer's listed.
 - 2. Where the words "or approved equal:" appear after a manufacturer's name, specific approval must be obtained from the Architect during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
 - 3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish a model or series designation, such designation is intended to establish quality level and standard features.

Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval.

- C. Substitute equipment of equal quality and capacity will be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.
- D. Before bidding equipment, and again in the preparation of shop drawings the Contractor and his supplier shall verify that adequate space is available for entry and installation of the item of equipment, including associated piping and accessories. Also verify that adequate space is available for servicing of the equipment.
- E. If extensive changes in pipe, duct or equipment layout or electrical wiring and equipment are brought about using equipment which is not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in the contract.

1.19 SHOP DRAWINGS

- A. Refer to Section 016000 Product Requirements.
- B. One set of shop drawings, in electronic format (pdf), with descriptive information shall be assembled by each Contractor of equipment and materials furnished in his contract and submitted to the Architect and/or Engineer for review as stated in Division 01. These shall be submitted as soon as practicable and before special equipment is manufactured and before installation.
- C. Shop drawings for equipment fixtures, devices and materials shall be labeled and identified as on the Contract Documents. Failure to do so may be cause for rejection of shop drawings.
- D. The review of shop drawings by the Architect or Engineer shall not relieve the Contractor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.
- E. Shop drawings for the following HVAC equipment and materials shall be submitted:
 - 1. Pipe, fittings and joining methods for the various systems.
 - 2. Firestopping systems for pipe penetrations.
 - 3. Pipe Hangers and Supports.
 - 4. Valves.
 - 5. Flexible Connectors.
 - 6. Meters and Gauges.
 - 7. Vibration Isolators.
 - 8. Pipe Insulation.
 - 9. Equipment and Breeching Insulation.
 - 10. Ductwork Insulation.
 - 11. Ductwork and Sealing Systems.
 - 12. Air Duct Accessories.
 - 13. Tanks.
 - 14. Hydronic System Specialties.

15. Pumps.
16. Water Treatment Systems.
17. Boilers and Burners.
18. Prefabricated Stacks and Flues.
19. Air-Cooled Chillers.
20. Unit Heaters.
21. Central Air Handling Units.
22. Fans.
23. Roof Ventilators.
24. Air Filters.
25. Specialty exhaust system equipment and components.
26. Dust collection system equipment and components.
27. Fire Dampers.
28. Smoke Dampers.
29. Air Control Terminal Units.
30. Diffusers, Registers and Grilles.
31. Louvers.
32. Temperature Controls System.
33. Pressure piping system welder performance qualification record per the Ohio Pressure Piping Systems Code, Chapter 4101:8.

1.20 FINAL INSPECTION AND PUNCH LIST

- A. Refer to Section 017700 Closeout Procedures.
- B. As the time of work completion approaches, the Contractor shall survey and inspect his work and develop his own punch list to confirm that it is complete and finished. He shall then notify the Architect and request that a final inspection be made. It will not be considered the Architect's or Engineer's obligation to perform a final inspection until the Contractor has inspected the work and so states at the time of the request for the final inspection.
- C. Requests to the Architect, Engineer or Owner for final inspection may be accompanied by a limited list of known deficiencies in completion, with an appropriate explanation and schedule for completing these; this is in the interest of expediting acceptance for beneficial occupancy.
- D. The Architect and/or Engineer will inspect the work and prepare a punch list of items requiring correction, completing or verification. Corrective action shall be taken by the Contractor to the satisfaction of Architect and Engineer within 30 days of receipt of the Architect/Engineer's punch list.

1.21 OPERATION AND MAINTENANCE MANUALS

- A. Refer to Section 017823 Operation and Maintenance Data.
- B. Two copies each of operating and maintenance manuals shall be assembled for the HVAC work by the Contractors.
- C. All shop drawing and installation, maintenance and operating instruction pamphlets or brochures, wiring diagrams, parts list and other information, along with warranties, shall be

obtained from each manufacturer of the principal items of equipment. Air and water balance reports shall also be included. In addition, the Contractor shall prepare a chart listing all items of equipment which are furnished under his contract and indicating the nature of maintenance required, the recommended frequency of checking these points and the type of lubricating media or replacement material required.

- D. These shall be assembled into three-ring loose lead binders or other appropriate binding and also combined into a single electronic file in .PDF format. An index and tabbed sheets to separate the sections shall be included. These shall be submitted to the Architect or Engineer for review. Upon approval, manuals shall be turned over to the Owner.

1.22 RECORD DRAWINGS

- A. Refer to Section 017839 Project Record Drawings.
- B. Each Contractor shall maintain a separate set of prints of the contract documents and shall show all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work, these drawing shall be turned over to the Architect.

1.23 WARRANTIES

- A. Refer to Section 017700 Closeout Procedures.
- B. This Contractor shall warrant all workmanship, equipment and material entering into this contract for a period of one year of date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect. Any materials or equipment proving to be defective during this warranty period shall be made good by this Contractor without expense to the Owner.
- C. This provision is intended specifically to cover deficiencies in contract completion or performance which are discovered after systems are placed in operation. Also included shall be supplementary assistance in balancing, adjusting or providing operating instructions as the need develops, and replacing overload heater elements in starters where necessary to keep systems in operation. Heater element sizes shall not exceed the motor manufacturer's recommendations.
- D. This provision shall not be construed to include maintenance items such as replacing filters, re-tightening or repacking glands, greasing, oiling belt tightening and cleaning strainers after these have been done for final close-out.
- E. Provisions of this warranty shall be considered supplementary to warranty provisions under General Conditions.
- F. Extended warranties shall be provided where indicated in the equipment specification sections.

1.24 PROJECT CLOSEOUT

- A. Refer to Section 017700 Closeout Procedures.

- B. The following schedule summarizes actions to be taken or submittals to be completed by Contractor prior to issuance of the Contract Completion Certificates. Refer to applicable paragraphs of the Division 23 Sections and other applicable trade Divisions for additional requirements. This information should be submitted at least thirty days in advance of request for final inspection. Where possible, the information shall be bound in 8 – ½' x 11" hard back binders.

1. Material / Suppliers List
2. Record Drawings
3. Certificate of Inspection
4. Tests and Adjustments
5. Operating Instructions and Maintenance Manuals
6. Equipment and Piping Identification
7. Receipt of spare pump seals
8. Receipt of spare filters
9. Completed Punchlist
10. Waiver of Liens
11. Affidavit of Wage Compliance
12. Change Orders and Allowance Adjustments

1.25 OPERATION AND ADJUSTMENT OF EQUIPMENT

- A. As each piping system and air distribution system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing air and water systems, adjusting fan speeds, belts, pulleys, tightening packing glands, and adjusting all operating equipment.
- B. Caution: Verify that all bearings are lubricated, all motors are operating in the right direction, and correct overload heater elements are provided on all motors. Do not depend wholly on the electrician's judgment in these matters. Follow specific instructions in regard to lubrication. Do not oil or grease presealed ball bearings unless upon manufacturer's specific instructions.
- C. Test relief valves, air vents and regulating valves to insure proper operation.

1.26 OPERATING DEMONSTRATION AND INSTRUCTIONS

- A. Refer to Section 017900 Demonstration and Training as well as individual Division 23 Sections for requirements.
- B. The Contractor shall set the various systems into operation and demonstrate to the Owner and Architect that the systems function properly and that the requirements of the Contract are fulfilled.
- C. The Contractor shall provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.
- D. A minimum of 16 hours shall be allowed for instructions to personnel selected by the Owner. Instructions shall include not less than the following:

1. Show locations of items of equipment and their purpose.
2. Review binder containing instructions and equipment and systems data.
3. Coordinate written and verbal instructions so that personnel understand each.
4. Separate instructions shall be given by manufacturer's representatives for the temperature control systems.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION – NOT APPLICABLE

END OF SECTION 23 0001

SECTION 23 0002 – HVAC WORK IN EXISTING BUILDINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section Includes the following:
 - 1. General Requirements for Renovation Work
 - a. Inspection of Existing Building
 - b. Asbestos Material
 - c. Work Hours
 - d. Tobacco Products
 - 2. Execution
 - a. Barriers and Signage
 - b. Storage of Tools and Materials
 - c. Protection of Existing Building and Equipment
 - d. Confined Spaces
 - e. Noise, Fumes, and Dust Control
 - f. Soldering, Welding, and Cutting
 - g. Removals, Disposal, and Reuse
 - h. Draining, Flush, and Refill of Piping Systems
 - i. Continuity of Systems
 - j. Wall, Floor, and Roof Openings – Existing Construction

1.2 GENERAL REQUIREMENTS FOR RENOVATION WORK

- A. Refer to Article 1 Specification requirements and notes on the drawings where provided for requirements related to renovation work.
- B. Meet with the Owner, Architect and Engineer before demolition or construction begins to establish procedures for work effort in the existing building. Provide names and phone numbers and establish emergency contact information where work is performed. Provide security information requested by the Owner for all personnel who will be working on site. Educate all construction personnel in regard to the project requirements and procedures.
- C. Coordinate effort with other contractors involved in the renovation project to minimize the disruption, phasing of work, share cleaning responsibilities, etc.

1.3 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.4 INSPECTION OF EXISTING BUILDING

- A. Each bidder shall inspect the existing building in the early time frame of the bidding period. Conditions shall be compared with information shown on the drawings. Report to the Architect/Engineer any significant discrepancies which may be discovered in a timely fashion so that direction may be provided in an addendum. After the contract is signed, no allowance will be made for failure to have made a thorough inspection.

1.5 ASBESTOS MATERIAL

- A. Abatement, removal or encapsulation of existing materials containing asbestos is not included in the Contract. Necessary work of this nature will be arranged by the Owner to be done outside of this construction and remodeling project by a company regularly engaged in asbestos abatement. Such work will be scheduled and performed in advance of work in the construction and remodeling project.
- B. If, in the performance of the mechanical work, materials are observed which are suspected to contain asbestos, the Contractor shall immediately inform the Architect / Engineer who in turn will notify the Owner. Work that would expose workers to the inhalation of asbestos particles shall be terminated. Work may be resumed only after a determination has been made and unsafe materials have been removed or encapsulated and the area declared safe.

1.6 WORK HOURS

- A. Work hours for construction shall be as defined in Section 01150 – Project Phasing or other specification sections or drawing notes.
- B. Where allowed, contractors may work normal hours except after hours is required for operations that are noisy, generate obnoxious fumes or dust, require shut down of ventilation systems, etc. The Owner reserves the right to stop normal hour work where the Owner deems the effort to be disruptive to their ongoing operations.
- C. Any work that creates hazards in or requires closure of corridors, exit pathways or stairwells work in corridors must be performed after hours when the building is not occupied.
- D. All occupied areas, corridors exit pathways and stairwells must be left clean, lighted (including emergency egress and exit signage) usable and safe at the end of each work shift.
- E. Access to the work area shall be coordinated with the Owner; follow all security protocols for parking, sign in, key control, etc. established by the Owner.

1.7 TOBACCO PRODUCTS

- A. Smoking or chewing tobacco products are expressly prohibited to be used within the building and on the premises except where specifically permitted by the Owner or in construction company trailers or vehicles where permitted by the construction company.

PART 2 - PRODUCTS- NOT APPLICABLE

PART 3 - EXECUTION

3.1 BARRIERS AND SIGNAGE

- A. Barriers and signage shall be provided as appropriate to identify work areas and to prevent unauthorized entry by non-construction personnel. Refer to appropriate Division 1 specification requirements and notes on the drawings where provided.
- B. All barriers and signs should be high visibility type and be maintained at all times.

3.2 STORAGE OF TOOLS AND MATERIALS

- A. Store all site material and tools in the active job site area or on-site areas, to be coordinated with Owner. Specific storage areas are not provided except where otherwise noted for material and tools.
- B. Storage is specifically prohibited in means of egress paths and stairwells.
- C. The contractor is responsible for the security of tools, equipment, and materials.
- D. On-site storage areas should be in locked trailers.

3.3 PROTECTION OF EXISTING BUILDING AND EQUIPMENT

- A. The Owners' property and the property of other contractors shall be respected at all times. Provide drop clothes, visqueen plastic sheeting or other suitable barriers where dust and debris is generated. Tape or zipper ends of barriers for sealing purposes.
- B. Provide 55-gallon drums or smaller buckets as appropriate and use funnels when draining liquid systems.
- C. Provide plywood sheets for heavy duty for protection of walls, floors or Owner equipment or systems that are remaining in place near demolition or new installation work where there is possible damage from heavy material or equipment.
- D. Provide ram board floor protection in occupied areas adjacent to construction areas.

3.4 CONFINED SPACES

- A. Notify the Owner when performing work in confined spaces. Provide a written procedure for approval and obtain approval from the Owner when so requested.
- B. All work in confined spaces shall be done in accordance with OSHA regulations.

3.5 NOISE, FUME, AND DUST CONTROL

- A. Provide barriers and ventilation as required to limit the effect from construction generated noise fume and dust control on spaces that continue to be occupied by the Owner. Refer to protection of building and equipment paragraph above. In addition to the basic protection, provide additional visqueen barriers to limit airborne migration of dust and fumes. Provide supplemental portable fans to exhaust air to the outside of the building where appropriate. Use of the Owners' ventilation systems to induce positive or negative pressure is prohibited unless authorized by the Owner. Shut off ventilation systems serving the area where use of these systems can induce fumes or dust into return or exhaust ducts. Where systems need to remain operational for occupied areas, arrange to temporarily shutoff portions of the system in the work area. Provide taped visqueen covers on HVAC air supply and exhaust devices to limit migration. Coordinate all efforts requiring modification or shutdown of ventilation systems with the Owner. Contractor shut down of these systems is prohibited without Owner permission.
- B. Fire Alarm System Coordination – Arrange with the Owner when required to shut off fire alarm system devices and/or smoke detectors to perform work. With the Owners' prior approval. Cover smoke detectors where needed to prevent false alarms due to dust or fumes generated. Minimize outages and coordinate efforts to limit the effect due to false alarms.
- C. Ventilation – Where significant dust or fume generating work, welding, or cutting operations are required for removal or new work, provide fume removal equipment with telescoping arms to locally capture the fumes. Fume exhaust shall be directed outside or adequately filtered and recirculated.
- D. Daily Ventilation – Areas shall be thoroughly ventilated after completion of the work daily to remove residual odors and fumes before occupancy occurs the next day.
- E. Cleaning – Provide walk off sticky construction pads at entrances to construction site and vacuum cleaners and other equipment to clean and restore conditions.

3.6 SOLDERING, WELDING, AND CUTTING

- A. For soldering, welding, or cutting operations, provide insulated, fire rated curtains or barriers and blankets to isolate cover and protect remaining systems and materials, furniture, furnishings, floors, walls, ceilings, etc.
- B. Refer to noise, fumes, and dust control provisions in the previous paragraph.
- C. Obtain burn approval from the Owner before commencing any soldering or welding effort. Coordinate outages of fire alarm systems as noted in the previous paragraph.
- D. Provide a Fire Watch at each welding location. Fire Watch personnel shall be dedicated for the sole purpose of fire prevention during welding operations. All Fire Watch personnel shall be properly trained and equipped, including fire extinguisher, fire blanket and communication equipment for assistance request.
- E. Provide a fire extinguisher at every soldering or welding location.

3.7 REMOVALS, DISPOSAL, AND REUSE

- A. Refer to the drawings for the scope of remodeling in the existing building.
- B. General – Cooperate with the General Contractor regarding all removal and remodeling work. Each Contractor shall remove existing utilities and equipment which is associated with their trade, and which will be superfluous when the new work is installed and made operational.
- C. Protection – In areas of minor work where the space is not completely vacated, temporarily move portable equipment and furnishings within the space as required to complete the work. Coordinate this activity with Owner. Protect the Owner's property by providing adequate dust covers and temporary plastic film barriers to contain dust. Provide filters on return/exhaust grilles and ductwork. Existing materials and finishes are to be protected and restored to match adjacent finishes. Remove barriers and return equipment and furniture upon completion of the work.
- D. Ceiling Removals – The H.C. shall remove, store and reinstall lay-in ceiling tile and grid as required to perform work in areas where such removal and re-installation is not to be done by the General Contractor. Damaged tile and/or grid shall be replaced with new matching tile and/or grid.
- E. Supports & Hanger Removals – Where piping, ductwork, equipment, and other materials are noted to be removed the removal shall include all hangers and supports for these items. Remaining active piping, ductwork and equipment shall be re-supported as required. New supports shall utilize approved and recognized materials and methods and be installed in accordance with the drawings.
- F. Removals – Extraneous ductwork, piping, wiring, or equipment which is or becomes accessible shall be removed and stubs shall be capped at the first active duct or pipe encountered. Piping that is and remains inaccessible shall be abandoned. Ends of abandoned pipe shall be capped so as to be concealed by finished surfaces. Upon completion of the work, no abandoned pipe, valve, or stub shall extend through finished floors, walls, or ceilings.
 - 1. Wall Removals –
 - a. Recessed devices – Devices to be abandoned in existing walls which are to remain shall be covered by suitable blank cover plates to match other devices cover plates or painted to match wall color.
 - b. Surface Mounted Devices - Where removals are completely removed from the face of wall, patch and finish wall consistent with adjacent finish. Surface mounted devices to be removed shall have surface repaired and finished to match adjacent existing or new architectural finishes.
 - 2. Roof Removals – Devices, services, supports and equipment removed from the roof shall leave the roof consistent with the existing or new roof. Patch the roof decking per the Patching section. The Contractor shall engage a roofing contractor to patch roofing consistent with the roof warranty.
 - 3. Floor Removals – Devices removed from concrete floors shall be patched and finished according to the patching section.
- G. Rerouting of Services – Where it is necessary to reroute a section of active piping or ductwork, the rerouted section shall be installed before removing the existing to minimize system down time. Rerouted sections shall be insulated as required for new work. Patch insulation on existing piping which has been damaged or removed in this work.

- H. Service Disruption – If any existing equipment or devices to remain in service in adjacent spaces are made inactive by removal of devices, wiring, piping or ductwork within the area of work shall be re-fed as required to make devices or equipment operational.
- I. Material & Equipment Removal & Reuse – Materials and equipment which are removed shall not be reused within the scope of this project unless specifically noted to be relocated or reused. Items noted in the drawings shall be turned over to the Owner and placed where directed on the premises. All material and equipment which the Owner does not wish to retain shall become the property of the Contractor responsible for removal and shall be removed from the premises and properly disposed.
- J. Disposals – The Contractor is responsible for the proper disposal of removed materials from the construction site. Provide dumpsters as required in locations coordinated with the Owner. Disposal of materials regulated by EPA shall be done in strict accordance with latest requirements. Provide documentation to the Owner that disposal was properly executed.
- K. Damaged Services & Insulation – Existing piping and ductwork to remain with damaged insulation encountered in area of work shall have damaged insulation removed and replaced with new. Insulation thickness shall match new thicknesses indicated on drawings. Work to be performed on a time and material basis as encountered. Services damaged during construction shall be replaced at the expense of the Contractor.
- L. Openings & Patching – Openings left where existing equipment, ductwork, piping and supports are to be removed in existing walls and ceilings to remain shall be patched using materials to match the existing construction, which may include fire stopping of rated walls and ceilings. Refer to Section 3.10 for patching methods.

3.8 DRAINING, FLUSHING, AND REFILL OF PIPING SYSTEMS

- A. Existing liquid systems shall be drained as required before removal or connection of new piping extensions.
- B. Draining of the system shall be the responsibility of the contractor. Provide threaded connections, etc. to direct fluids to drainage points. Water systems may be drained to sanitary systems or where permitted, to storm systems. Verify any chemical treatment, inhibitors or freeze protection additives in the existing systems and obtain a permit from the local sewer authority before disposing.
- C. Provide drums or containers to accept other than water drainage and remove from the premises and properly dispose. Provide visqueen to protect Owners' property when opening pipes, even where piping has been drained to prevent damage from residual liquid that remains in the pipe.
- D. After new piping is connected and tested, flush and clean all existing piping that has been drained and new piping as specified in Section 23 0001, Basic HVAC Requirements. Provide full port, 0.75" ball valves with hose connectors as described to facilitate flushing operations.
- E. Inspect and clean any new or existing strainers at coils, heat exchangers, etc. that may become clogged due to debris that may dislodge from interior pipe surfaces due to the draining, flushing and detergent cleaning operations.

- F. During refilling and startup operations, vent all air from the system at high points. This air venting effort shall extend beyond the refill and initial startup where flow blockage due to air binding occurs.

3.9 CONTINUITY OF SYSTEMS

- A. Coordination –
 - 1. Work shall be so planned and executed as to provide reasonably continuous services of existing systems throughout the construction period. Where necessary to disrupt services for short periods of time for connection, alteration, or switch-over, the Owner shall be notified in advance and outages scheduled at the Owner's reasonable convenience.
- B. Sequence of Operations – Submit, on request, a written step-by-step sequence of operations proposed to accomplish the work. The outline shall include tentative dates, times of day for disruption, downtime, and restoration services. Submit the outline sufficiently in advance of the proposed work to allow the Architect or Engineer to review the information with the Owner. Upon approval, final planning and the work shall be done in close coordination with the Owner.
- C. Shutdown of system and work undertaken during shutdowns shall be bid as being done during normal working hours. Portions of the existing system shall be shut down during the phasing of the project. If the Owner should require such work be performed outside of normal working hours, reimbursement shall be made for premium time expenses only.

3.10 WALL, FLOOR, AND ROOF OPENINGS – EXISTING CONSTRUCTION

- A. Refer to Division 1 – General Requirements for information regarding cutting and patching.
- B. Coordination – Plan the work well ahead of the general construction. Where pipes and ducts are to pass thru new walls, partitions, floors, roof or ceilings, place sleeves in these elements or arrange with the General Contractor to provide openings where sleeves are not practical. Where sleeves or openings have not been installed, cut holes and patch as required for the installation of this work, or pay other trades for doing this work when so directed by the Architect. Any damage caused to the building shall be repaired or rectified.
- C. Cutting – Where pipes and ducts are to pass through, above or behind existing walls, partitions, floors, roof, or ceiling, cutting, patching, and refinishing of same shall be included in this contract. Core drilling and saw cutting shall be utilized.
- D. Structural Support – Provide steel angle or channel lintels to span openings which are cut in existing jointed masonry wall where the opening span exceeds 16 inches. Provide framing around roof openings for required support of the roof deck. Consult with a structural engineer to provide adequate size and shapes for loading.
- E. Roofing Work – The HVAC Contractor shall engage a Roofing Contractor on a subcontractor basis for roofing and roof insulation work necessitated by his work. The Roofing Contractor shall be certified for installation and repair of the roofing system to maintain the existing roofing warranty.

- F. Patching & Refinishing – All material, methods and procedures used in patching and refinishing shall be in accordance with applicable provisions of specifications governing the various trades. The final appearance and integrity of the patched and refinished areas must meet the approval of the Architect. Wall, floor, and ceiling refinishing must extend to logical termination lines (entire ceiling of the room repainted, for instance), if an acceptable appearance cannot be attained by finishing a partial area.
1. CMU Walls – Grout small penetrations closed. Patch in new blocking for holes larger than one CMU.
 2. Brick Masonry Walls – Patch in with existing brick if possible, or new brick and mortar to match color and finish pattern.
 3. Gypsum Board Walls & Ceilings – Replace with new gypsum board and finish to match existing or new condition, respectively.
 4. Structural Metal Roof/Floor Decking – Replace with new decking, same as existing size. Insulation thickness and roofing materials to match existing roof system.
 5. Concrete Floors & Walls – Grout penetrations closed, or place new concrete and rebar as required for large openings.
 6. Wood floors & Walls – Patch consistent with type of wood.

END OF SECTION 23 0002

SECTION 23 0004 – FIRESTOPPING FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
- B. Related Sections:
 - 1. 23 0529 Pipe Hangers, Supports, and Penetrations

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Firestopping assemblies shall be tested and rated in accordance with ASTM E814 (ANSI/UL 1479) Fire Tests of Through-Penetration Fire Stops (minimum positive pressure of .01 inches of water column) and E119 (ANSI/UL 263) Fire Tests of Building Construction and Materials Time-Temperature Curve. Firestopping shall provide an “F” fire rating equal to that of the construction being penetrated. Firestop systems shall meet all requirements of the Ohio Building Code.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - 2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

- D. For through-penetration firestop systems exposed to view or above ceilings in air return plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Shop drawings shall be certified to ASTM E814 (ANSI/UL 1479).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Firestopping materials shall be manufactured and/or supplied by:
 - 1. Hilti, Inc.
 - 2. Specified Technologies Inc.
 - 3. 3M; Fire Protection Products Division.

2.2 FIRESTOPPING

- A. Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. Where required, these shall be installed in conjunction with sleeves and materials for fill and damming.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.
- B. Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.
- C. Provide firestop system for every pipe or duct at penetration of all fire resistance rated walls and horizontal assemblies.
 - 1. For rated horizontal assemblies, provide cast-in-place combination pre-set floor sleeve equal to Hilti CP 680.

- D. Provide rigid supports for ducts or pipes on both sides of the fire resistance rated wall or assembly where required as part of the fire stop assembly.
- E. Coordinate opening size and additional framing requirement with the General Contractor for each opening to meet the firestop installation requirements.
- F. Annular space of penetrations of nonfire-resistant-rated floor, floor/ceiling assemblies, or the ceiling membrane of a nonfire-resistant rated roof/ceiling assembly shall be sealed with a firestopping system to resist the free passage of flame and products of combustion.
- G. Where ducts penetrate fire rated assemblies and fire dampers are not indicated, the penetration shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E814 (ANSI/UL 1479).
- H. Smoke Barriers:
 - 1. Penetrations shall be sealed with a firestopping system to prevent the passage of smoke.
- I. Smoke Partitions:
 - 1. Penetrations shall be sealed with a caulking material to prevent the passage of smoke.
Non-rated smoke partitions do not require a fire stopping system.

END OF SECTION 23 0004

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SECTION 23 0513 - ELECTRICAL REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for electrical work for HVAC equipment including single-phase and polyphase, 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 and other electrical equipment, devices, fuses, wire, conduit and installation methods.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

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.
- B. Refer to the Mechanical and Electrical drawings for requirements related to each trade. Coordinate all aspects of electrical components and wiring to complete the systems.

1.4 QUALITY ASSURANCE

- A. Equipment and devices shall be designed, constructed and installed in accordance with applicable standards of NEMA and the National Electric Code. Equipment shall be tested and listed by UL or other approved agency and installed in accordance with all instructions included as part of such a listing.
- B. Electrical equipment, devices, fuses, wire, conduit and methods shall comply with applicable provisions of Division 26 - Electrical.

PART 2 - PRODUCTS

2.1 MOTORS

- A. General duty motors shall be induction type 1750 rpm NEMA Design "B" with copper windings, Class B or F insulation, and motor enclosure to suit the application. Service factor shall be 1.15 minimum.
- B. Two-speed motors shall be two-winding type with six leads unless otherwise specified.
- C. Motors for applications other than general duty shall be furnished to suit the application and operating environment.
- D. Premium efficiency motors shall be equal to Century "E + 3", General Electric "Energy Saver Premium Efficiency", Baldor "Super E Premium Efficient" or Reliance "Premium Energy Efficient" series. Motor efficiencies shall be tested and conform to NEMA Standard Publication MG-1 and IEEE 112 Test Method B.
- E. Motors used with variable frequency controllers shall be rated for inverter service in accordance with NEMA Standard Publication MG-1, Part 31, designed to handle 1600V at a 0.1 micro-second rise time and include Class F or H insulation, but with a Class B temperature rise. Motors shall be equipped with a maintenance free, conductive microfiber, shaft grounding ring with a minimum of two rows of circumferential microfibers to discharge electrical shaft currents within the motor and/or its bearings.
- F. Electronically Commutated Motors – Fans
 - 1. Motor enclosures: Open Drip Proof, Totally Enclosed Fan Cooled, Totally Enclosed Air Over, Totally Enclosed Non-Vented
 - 2. Electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors.
 - 3. Motors are permanently lubricated, heavy duty ball bearing type to match with the equipment load and pre-wired to the specific voltage and phase.
 - 4. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor or integrated variable frequency drive.
 - 5. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.
 - 6. Motors can achieve up to 95% efficiency, model and horsepower dependent.
- G. Motor sizes shown on the drawings are to be considered minimum. Motors furnished shall be sized to not operate in the service factor range. Motors for direct driven pumps and fans shall be selected to not operate in the service factor range at any point on the curve.
- H. The HVAC Contractor and equipment suppliers shall compare the electrical power requirements of the intended equipment with power feeders to the equipment shown on the Electrical drawings. Verify adequacy and compatibility of voltage, phase, wiring, capacity, number and size of conductors (versus equipment connection points), fusing and other information on the electrical and mechanical drawings to that required for the equipment. If the

selected equipment requires revision of the electrical, added cost must be borne by the HVAC Contractor.

2.2 STARTERS

- A. Magnetic starters shall comply with provisions of Division 26 - Electrical Specifications and shall be NEMA construction (IEC rated not acceptable) with thermal overload element on each phase, 115-volt control voltage and hand-off-automatic switch, where appropriate. An integral control transformer shall be incorporated in the starter for each motor of 200 volt and greater. A single control transformer is acceptable for multiple motor packaged equipment, however, when such is the manufacturer's standard. Duplex type units (pumps, compressors, etc.) are not included in this exception. A control transformer shall be provided in each starter to ensure standby operating capability.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Motor connections of factory assembled equipment shall be made with flexible conduit except for plug-in electric cord connections.
- B. All power wiring shall be run in conduit. Control wiring shall be run in conduit except where open wiring is permitted in other applicable specification sections.
- C. Fuses shall be furnished and installed in fuse clips of equipment and switches provided by the Mechanical Contractors.
- D. If a non-basis of design manufacturer is provided by the HVAC contractor and the specific unit has a powered component with a MCA and/or MOCP greater than the basis of design, the HVAC contractor shall be responsible to provide all required electrical changes required to power the non-basis of design unit. The HVAC contractor shall coordinate with the Electrical Contractor any variances in the MCA and/or MOCP of the units provided.

END OF SECTION 23 0513

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SECTION 23 0519 - METERS AND GAUGES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermometers.
2. Pressure Gauges.
3. Pressure-Temperature (PT) Test Plugs.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 THERMOMETERS

- A. Thermometers shall be 9" blue reading organic spirit filled tube column type with cast aluminum case with epoxy finish, acrylic window, aluminum scale with white background and black markings, 1% accuracy, adjustable angle hinge assembly and 3.5" aluminum insertion stem.
- B. Provide a separable socket insertion thermowell shall be furnished with each thermometer. A lagging extension neck, with appropriate increase in thermometer stem length, shall also be furnished where piping is insulated.
- C. Ranges of thermometers shall be selected from standard Fahrenheit scales to be consistent with anticipated temperatures, typically:
1. Chilled Water Systems – 0°F – 160°F
 2. Heating Water Systems – 30°F – 240°F
- D. Manufacturer – Trerice BX91403 or approved equal.

2.2 PRESSURE GAUGES

- A. Pressure gauges, including compound gauges and vacuum gauges, shall be Bourdon tube type with 4-1/2" dial and cast aluminum case, measuring in psi, equal to Trerice 600CB Series. Accuracy shall be 1% at full scale.
- B. Pressure gauges for low pressure application, calibrated in inches of water gauge, ounces per sq. in., or 0-5 psi, as appropriate, shall be equal to Trerice 860.
- C. Pressure gauges at pumps shall be glycerine liquid filled Bourdon tube type with 4" dial and stainless-steel case and internals, measuring in psi, equal to Trerice 700 Series. Accuracy to be 1% at full scale.
- D. A brass cock or bronze ball valve and a pressure snubber shall be furnished with each pressure gauge.
- E. Ranges of pressure gauges shall be selected to be consistent with anticipated pressures. Range shall be approximately twice the normal system working pressure at the gauge location.

2.3 PRESSURE-TEMPERATURE (PT) TEST PLUGS

- A. Pressure-temperature test plugs for insertion of a pressure gauge or thermometer shall be a brass fitting with neoprene or Nordel self-sealing insert and knurled brass cap with plastic capture tab. Fittings shall be equal to Peterson "PT". Furnish two thermometers and two pressure gauges with integral insertion stem appropriate for use with the test plugs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Thermometers Locations – Install where shown on the drawings and also at: inlet and outlet of boilers, chillers, and air handling unit coils.
- B. Pressure Gauge Locations – Install where shown on the drawings, where required by applicable codes and at: inlet and outlet piping of pumps, boilers, chillers, hydronic storage tanks, upstream and downstream of pressure regulators and reducing valves, and air handling unit coils.
- C. Mounting –
 - 1. Thermometers and gauges shall be positioned to be read with unobstructed view from the floor.
 - 2. Pressure-temperature test plugs shall be installed where shown, located in a position to be most readable.
 - 3. Install thermometer wells in piping tees in the vertical position. Fill the well with oil or graphite and secure the thermometer in position.

END OF SECTION 23 0519

SECTION 23 0523 – GENERAL DUTY VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Butterfly valves.
2. Ball valves.
3. Check valves.
4. Gate valves.
5. Balancing-Shutoff valves.

B. Related Sections:

1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.
2. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.4 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- C. Sweat end valves of equal construction and features are acceptable in lieu of those specified with screwed ends. Valves of equal construction and features with ends compatible with grooved end pipe mechanical joint couplings are acceptable on such systems and may be manufactured by the coupling system manufacturer. Grooved end valves shall conform to ANSI/AWWA Standard C-606.

PART 2 - PRODUCTS

1. Refer to Valve Schedule on Drawings for approved valves.

2.2 SHUT-OFF VALVES

- A. Butterfly valves and ball valves in piping which are to be insulated shall have extended shaft necks to accommodate the insulation.

2.3 BALANCING – SHUTOFF VALVES

- A. A portable differential pressure gauge with cocks, hoses and connectors shall be provided in conjunction with the combination balancing-shutoff valves. Furnish additional gauges as appropriate if one gauge cannot facilitate the various valves.
- B. A molded polyurethane container shall be provided with each valve on cold services, to be utilized as an insulating cover.

2.4 MANUFACTURERS

- A. Valves shall be as specified above, or of equal construction manufactured by:
 1. Shut-Off Valves
 - a. Anvil, Apollo, Conbraco, Crane, Milwaukee, Nibco, Watts
 2. Check Valves
 - a. Nibco, Stockham, Watts
 3. Balancing Valves
 - a. Bell & Gossett, Armstrong, Watts

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Drain Valves – Drain valves shall be the same as for the shut-off service. Provide a ¾” hose thread adapter on the outlet of each drain valve that is not piped to a drainage point. Hose thread adapters on drain valves of potable water piping shall be fitted with a non-removable vacuum breaker. Provide with cap and chain.
- B. Protection – Internals shall be removed and the remaining elements of sweat end valves shall be protected against heat damage during soldering or brazing.
- C. Valve Installation – Valves shall be installed with the stem at or above the centerline of the pipe. Valves shall be located to be accessible for operation, servicing and/or removal.
- D. Adjustments – Packing glands shall be tightened before placing the valves in service.

END OF SECTION 23 0523

SECTION 23 0525 – FLEXIBLE PIPE CONNECTORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Molded Sphere Pipe Connectors
 - 2. Corrugated Metal Pipe Connectors

1.2 SUBMITTALS

- A. Product Data:
- B. Shop Drawings:

1.3 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 MOLDED SPHERE

- A. Molded sphere pipe connectors shall be constructed of a spherical woven nylon molded neoprene body with wire reinforcing and cadmium plated steel flanges. Body shall be single or twin sphere as appropriate. Rated working pressure shall be 225 psi at max. 230°F. Pipe connectors shall be equal to Metraflex “Metrasphere”.

2.2 CORRUGATED METAL

- A. Corrugated metal pipe connectors shall be constructed of seamless corrugated inner tubing of Type 300 series stainless steel, woven wire braid outer jacket of the same alloy and flanged or grooved ends. Rated working pressure shall be safely in excess of the duty imposed. Pipe connectors shall be equal to Metraflex “MMC Metra-Mini”.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Flexible pipe connectors and piping shall be installed in accordance with manufacturer's recommendations. Piping shall be aligned (both axially and radially), movement of piping shall be confined and flange spacing set to not stress the connector or piping.

END OF SECTION 23 0525

SECTION 23 0529 – PIPE HANGERS, SUPPORTS, AND PENETRATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Hanger Rods and Attachments.
 - 4. Pipe Riser Supports
 - 5. Pipe Sleeves, Openings, Penetrations, Escutcheons, and Curbs
- B. See Division 23 Section “Metal Ducts” for duct hangers and supports.
- C. Related sections
 - 1. 23 0004 Fire Stopping for HVAC Systems

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS

- A. Hangers and supports for piping shall be equal to the Anvil catalog numbers as follows:
1. General Service – clevis type – Anvil Fig. 260.
 2. Uninsulated Copper Tubing - copper plated clevis type – Anvil Fig. CT-65 (or plastic coated clevis).
 3. Where the length of the hanger rod between the top of the hanger and the attachment is 3" or less, clevis type hangers with rollers, Anvil Fig. 181, shall be used to allow for expansion travel.
- B. Hangers on insulated horizontal piping shall be oversized to surround the pipe insulation. To protect the insulation from damage or inordinate compression due to concentrated weight, the following shall be provided at each hanger:
1. Pipe 2" and smaller – Anvil Fig. 168 18 ga. sheet metal rib-lock shield with belled ends, 12" long.
 2. Pipe 2-1/2" and larger – Factory fabricated assembly equal to Pipe Shields, Inc. A1000.

2.2 TRAPEZE HANGERS

- A. Trapeze hangers for numerous pipes run in parallel may be utilized. Horizontal support members shall be unistrut type section with pipe rollers (to allow for expansion travel) and spring and nut connectors, suspended with hanger rods and attachments similar to individual pipe hanger suspension.

2.3 HANGER RODS AND ATTACHMENTS

- A. Hanger rods shall be solid steel, threaded-end or all-thread rod, of diameter listed below. A hanger attachment device (for attachment to the structure) and locking nuts at the hanger attachment shall be provided on each hanger. Locking nuts shall be provided at each clevis hanger.

- B. Pipe Hanger Rod Size Schedule

<u>Pipe Size</u>	<u>Min. Rod Dia.</u>
1" and smaller	1/4"
1-1/4" to 3"	3/8"
4" to 6"	1/2"

8"	5/8"
10"	3/4"
12"	7/8"
14" to 16"	1"
18" to 20"	1-1/4"

C. Hanger rod attachment devices for attachment to the structure shall be:

1. After-set steel expansion type concrete inserts.
2. Beam clamps for steel construction equal to Anvil Fig. 92, 93, or 94. Utilize swivel type in sloped steel construction to provide vertical support of pipe without bending hanger rods.
3. Side beam bracket for wood construction equal to Anvil Fig. 206.

2.4 PIPE RISERS SUPPORTS

1. Insulated Pipe size 1-1/2" and smaller shall be factory (Pipe Shields E1000) or shop fabricated assembly Anvil Fig. 261 with high density calcium silicate insulation and galvanized steel jacket.
2. Insulated Pipe size 2" and greater shall be factory fabricated assembly Pipe Shields, Inc. E1000 or approved equal.
3. Un-insulated copper tubing – Anvil Fig CT-121 or CT-121C
4. Un-insulated steel piping – Anvil Fig. 261.

2.5 PIPE SLEEVES, OPENINGS, PENETRATIONS, ESCUTCHEONS AND CURBS

A. Piping Wall and Floor Sleeves – Non-Fire Rated Assemblies:

1. New Piping – New or Existing Walls and Floors
 - a. Poured Concrete - Schedule 40 black steel pipe of 18-gauge galvanized steel
 - b. Assemblies other than poured concrete – schedule 40 black steel pipe or 26-gauge galvanized sheet.
2. Existing Piping – New Walls and Floors
 - a. Poured Concrete Floors – 18-gauge Galvanized sheet metal
 - b. New walls and partitions – 26-gauge Galvanized sheet metal

B. Piping Wall and Floor Sleeves – Rated Assemblies

1. Refer to specification 23 0004 for requirements.

C. Roof Deck or Waterproof Floor Membrane Penetrations

1. J.R. Smith 1720, or equal, riser sleeve with clamping ring and auxiliary pipe sleeve extending 4" above finished floor or 8" above finished roof. Waterproofing membrane for roof and floor construction shall be secured by the clamping ring. These are to be used in areas having special membrane waterproofing in or on the floor slab and at roof decks.
2. Concrete curbs may be formed and poured around multiple pipe risers in rooms with waterproofing floor membrane, in lieu of the Smith 1720 riser sleeve and clamping ring. Curbs shall be 4" wide x 4" high with chamfered corners. Membrane and curbing shall be arranged to maintain the integrity of the membrane. Pipe sleeves shall be as described for normal areas or extended to the top level of the curb where the concrete is full depth throughout the curbed area.
3. Piping and conduits extending through the roof may be fitted with a manufactured pipe curb weatherproofing assembly equal to Sigrist Pipe Chase Housing or approved equal as an alternative to riser sleeves with clamping rings specified above. Provide 14" roof curb and all required piping exit seals.

D. Escutcheon Plates

1. Escutcheon plates shall be split-ring chromium plated pressed steel. Plates shall be sized to cover the surface penetration and sleeve. Plates shall be installed on exposed piping in finished rooms and areas where pipes penetrate walls, floors, ceilings or overhead structure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Spacing of hangers shall be as follows:

1. Steel pipe - Horizontal:
 - a. 2" and smaller – 8 ft. intervals
 - b. 2-1/2" thru 6" – 10 ft. intervals
 - c. 8" and larger – 12 ft. intervals.
2. Copper Tubing – Horizontal
 - a. 1-1/4" and smaller – 6 ft. intervals
 - b. 1-1/2" – 2" – 8 ft. intervals
 - c. 2-1/2" and larger – 10 ft. intervals

B. Refer to hanger installation details on drawings for installation information supplemental to this specification section.

C. Attachment of pipe hangers to the structure shall be with:

1. After-set concrete inserts, in 4" minimum depth concrete, set in drilled holes. Powder actuated driven fasteners are not permitted.

2. Provide anchoring where steel beam clamps are attached to sloping surfaces of beam flanges and where otherwise required to insure permanent attachment.
 3. Attachment to steel deck is prohibited. Span from steel structural members with supplementary steel shapes where direct attachment to structural members is not practical. This does not apply to steel deck with concrete slab poured deck. Refer to notes 1 and 2 above.
- D. Pipe hangers shall be adjusted to proper elevation and all hanger rods set in a vertical position before pipe insulation is installed.
- E. Extended legs of pipe riser clamps shall be shortened as needed to maintain concealment of the clamp within the pipe chase. Ensure that adequate support is still maintained.
- F. Hanger assemblies which will remain exposed on completion of the project shall be painted before installation.
- G. Pipe supports manufactured by Advanced Support Products or the approved equal for pipe running across the roof shall be installed in accordance with the manufacturer's instructions and as detailed. Install protective slip sheets of roofing membrane under the bases to satisfy the requirements of both the roofing manufacturer and the support system manufacturer.
- H. Pipe supports manufactured by Pate or the approved equal shall be installed per the manufacturer's instructions and flashed into place by a certified roofing contractor.

3.2 PIPE SLEEVES

- A. Pipe sleeves shall be placed in the initial stages of construction before concrete, masonry and other general construction activity. Means shall be taken to ensure that the sleeve will not move during or after construction. Beams, columns and other structural members shall not be sleeved except upon approval of the Architect.
- B. Sleeves are not required in the following:
1. In stud and gypsum board or plaster walls and partitions which are not fire rated.
 2. For uninsulated pipe passing thru masonry walls and partitions and stud and gypsum board or plaster walls and partitions.
 3. In core drilled openings in solid concrete not requiring water protection. Sleeves are required, however, at core drilling thru hollow pre-cast slabs and concrete block walls, to facilitate containment of required firestopping material.
 4. In large floor openings for multiple pipe and duct risers which are within a fire rated shaft, unless the opening is to be closed off with concrete or other material after pipe are set.
- C. Length of wall sleeves shall be such that the sleeve ends are substantially flush with both sides of the wall or partition. Floor sleeves shall be flush with the bottom and top of the floor slab except, in mechanical rooms and other areas which might have water on the floor, sleeves shall

project a minimum of 1" above finished floor. Pipe sleeves shall be sized to allow insulation to pass through the sleeve, for insulation requiring continuous vapor barrier (domestic cold water, chilled water refrigerant, etc.). Where vapor barrier continuity is not needed, the sleeve may be sized to pass the pipe only or the insulation as well. Refer to the following paragraph for qualification and exceptions relating to firestopping.

- D. Pipe sleeves which are part of firestopping assemblies shall conform to the requirements of the assembly with particular emphasis regarding size, annular space, length, passage or non-passage of insulation and the installation of the sleeves.
- E. Where firestopping is not required per this section and specification 23 0004, the annular space between the sleeve, core drilling or opening and the pipe or pipe insulation shall be closed with caulking to retard the passage of smoke.
- F. Where uninsulated pipes requiring no pipe sleeves pass through non-fire wall or partition, the annular space shall be closed with material and methods compatible with the wall or partition material (Type M masonry grout, drywall joint compound, plaster, etc.).

END OF SECTION 23 0529

SECTION 23 0530- EQUIPMENT BASES AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Concrete Bases
2. Roof Curbs
3. Structural Steel Supports

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 QUALITY ASSURANCE

- A. Coordinate exact dimensions, locations, and other details for the specific equipment provided with other trades.

PART 2 - PRODUCTS

2.1 CONCRETE BASES

- A. Concrete base pad with steel reinforcement as detailed on the drawings. Bases shall be formed on all sides and hand troweled to a smooth, dense finish with neatly chamfered corners. Large concrete pads on grade shall be constructed with reinforcing steel or reinforcing roadway mesh.

2.2 ROOF CURBS

- A. Rooftop equipment shall be supported with a heavy gauge, galvanized steel support curb with a baseplate, continuously welded corner seams, integral raised cant to match roof insulation, internal insulation, wood nailer, and counter flashing.
- B. Curb height shall be minimum 20" above roof deck unless otherwise noted.

2.3 STRUCTURAL STEEL SUPPORTS

- A. Structural steel angles, beams, or channels, Unistrut channels, or pipe supports shall be fabricated into a rigid framework with welded or bolted connections and cross / sway bracing.

- B. Supports shall be set of slab with baseplates or attached to permanent building structure.
- C. Wall brackets shall be anchored to steel framing members or masonry walls.

PART 3 - EXECUTION

3.1 WIND LOAD ANALYSIS

- A. HVAC Equipment, ductwork, piping, conduits, etc. exposed to wind shall have positive attachment to the building structure or ground to comply with wind load requirements of the building and mechanical codes.
- B. Wind speed design: 120 MPH.
 - 1. Refer to structural drawings for additional information.
- C. The contractor shall retain a specialty consultant to perform wind load calculations in accordance with the code and additional requirements in this section. A professional engineer experienced in wind load attachment design and installation shall be responsible for calculations, attachment selections, and installation details.
- D. The Wind Load Analysis consisting of attachment design, calculations, attachment selection, installation details including anchoring methods, fastener specifications, embedment and/or welded length, etc. shall be submitted for review and record. The submittal shall be signed and sealed by a professional engineer, as stated above. This submittal shall become part of the project design calculations, included in the project records, and when required, will be submitted to the Authority Having Jurisdiction (AHJ).
- E. The wind load attachment design shall clearly indicate the attachment points to the building structure and design forces in all horizontal and vertical axes at the attachment points. The wind load attachment engineer shall coordinate all attachments with the project structural engineer of record, who shall verify the attachment methods and the ability of the building structure to accept the loads imposed.
- F. The wind load attachment design shall be based on actual equipment data (dimensions, weight, center of gravity, etc.) obtained from submittals or the manufacturers. The equipment manufacturer shall verify that the attachment points on the equipment can accept the combination of wind load, weight, and other loads imposed.
- G. At the project Engineer of Record's discretion, equipment submittals may not be approved until the Wind Load Analysis has been submitted. It is the contractor's responsibility to schedule and coordinate the process in a timely manner, including revised Wind Analysis submittals for equipment approved pending Wind Analysis submittals.

3.2 INSTALLATION

- A. Roof curbs shall be installed, shimmed level, and secured to the roof deck/structure. Roof insulation and roofing shall be installed around each curb by the Roofing Contractor.

B. Equipment Bracing & Attachment

1. All equipment and curbs exposed to wind shall be installed and attached to structure in strict accordance with the Wind Load Analysis design. Attachment shall conform to the applicable building codes and manufacturers installation instruction.
2. No rigid connections between equipment and the building shall be made that would degrade vibration isolation.
3. Each manufacturer of equipment shall furnish a statement stamped by a professional engineer indicating that the equipment is designed and constructed to withstand wind loads required by the building codes. Statement shall include supporting documentation, calculations, etc.

- C. Attachment to manufactured trusses, joists, purlins, and other engineered structural members and supports shall be done in accordance with the structural engineer's or manufacturer's recommendations. Refer to the architectural and structural engineer drawings for type of engineered structural system being used. Connections to these structural members shall be made with connection devices and methods approve by the structural engineer or manufacturer. Provide additional supports with supplemental steel shapes when spacing between structural members exceed specified distances. In cases of existing trusses, the structural engineer shall review and approve hanger attachment methods.

END OF SECTION 23 0530

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SECTION 23 0548 - VIBRATION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Vibration Isolators

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Indicate inertia bases and locate vibration isolators.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Open Spring Isolator

1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
2. Spring Mounts: Provide with leveling devices, 0.25-inch neoprene sound pads and zinc chromate plated hardware.
3. Mason Industries Series "SLFH"

- B. Housed Spring Isolators

1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
2. Spring Mounts: Provide with leveling devices, 0.25 inch neoprene sound pads and zinc chromate plated hardware.
3. Restraint Housing: Cast steel housing with non-adjustable neoprene sponge inserts
4. Mason Industries Series "C".

- C. Neoprene Mounts

1. Mount: Double deflection neoprene with a minimum static deflection of 0.35". All metal surfaces shall be neoprene covered to prevent corrosion and have friction pads both top and bottom.
2. Mason Industries Series "ND"

D. Neoprene Pad Isolators

1. Pad shall be 1" thick sandwich type consisting of a 0.5" cork center with 0.25" neoprene waffle pad top and bottom.
2. Mason Industries Series "NK".

E. Spring Hanger

1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
2. Housings: Neoprene in shear or double deflection LDS rubber upper and lower elements.
3. Mason Industries Series "30N"

F. Neoprene in Shear Hanger

1. Element: Double deflection LDS rubber isolator color coded for load carrying capacity.
2. Mason Industries Series "HD".

G. Concrete Inertia Base

1. Forms: Rectangular concrete pouring forms including minimum 0.5" bars welded in place on 6" centers running both ways.
2. Templates: Forms shall be furnished with steel templates to hold the anchor bolt sleeves and anchor bolts while concrete is being poured.
3. Springs: Springs shall be as specified in Open Springs above.
4. Mason Industries Series "K" or "BMK"

2.2 MANUFACTURERS

- A. Mason Industries.
- B. Kinetics Noise Control
- C. Amber Booth

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Isolators installed outside shall be furnished weather protected with springs PVC coated and other ferrous parts hot dip galvanized or cadmium plated.

- B. Isolators for chillers, cooling towers, boilers and other equipment with significant water capacity shall be equipped with vertical limit stops.

3.2 INSTALLATION

- A. Follow manufacturer's instructions in setting and adjusting isolators. Ensure that no direct hard surface to surface contact occurs. Fasten device to floor as recommended by the isolation supplier.
- B. Where electrical connections are to be made to equipment mounted on isolators, inform the Electrical Contractor to connect to the equipment with flexible conduits.
- C. See Specification Section 23 0529 Pipe Hangers and Supports for spring hanger locations and hanger installation requirements.
- D. Adjust isolators after piping system is at operating weight.
- E. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- F. Adjust active height of spring isolators.
- G. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 23 0548

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SECTION 23 0553 - IDENTIFICATION FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment Labels.
2. Pipe Labels.
3. Valve Tags.
4. Duct Labels.
5. Controls Equipment Labels.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTAL

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Labels, tags and markers shall comply with ANSI A13.1 for lettering size, colors and length of color field.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Each item or major equipment shall be labeled. This should include boilers, chillers, pumps, air handling units, fans, tanks and other similar hydronic equipment.
- B. Labeling shall be:
1. Permanently attached engraved brass or plastic laminated signs with 1" high lettering. Signs on exterior equipment shall be brass.
 2. Stencil painted identification, 2" high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel.

3. In addition to the labeling attached to each VAV terminal unit, provide a colored sticker on the ceiling grid below each VAV to mark its location.

2.2 PIPE LABELS

- A. Pipe markings shall be applied to all piping.
- B. Labeling shall be:
 1. Plastic semi-rigid snap-on type, manufacturer's standard pre-printed color-coded pipe markers extending fully around the pipe and insulation or pressure-sensitive vinyl pipe markers similar to above.
 2. On piping and insulation 6" and greater diameter, full band as specified above or strip-type markers fastened to the pipe or insulation with laminated or bonded application or by color-coded plastic tape not less than 1-1/2" wide, full circle at both ends of the marker.
- C. Identification markings shall include service (e.g. hot, chilled, steam) and arrows indicating direction of fluid flow provided integral with the pipe marker or separate at each marker.

2.3 VALVE TAGS

- A. Each shutoff valve, other than at equipment, shall be identified with a stamped tag. Valves and tagging shall be scheduled, typewritten on 8-1/2" x 11" paper, tabulating valve number, piping system, abbreviation, location of valve (room or area) and service (e.g. – south wing reheat boxes).
- B. Valve tags shall be polished brass or plastic laminate with solid brass S hook. Tags shall be engraved with "H" for HVAC and the designated number.

2.4 DUCT LABELS

- A. Duct markings shall be applied to all ductwork.
- B. Identification markings shall include service (e.g. supply, return, exhaust, outside air) and direction of air flow provided integral with duct marker or separate at each marker.
- C. Duct markings shall be laminated plastic color-coded pressure sensitive vinyl tape, 2-1/2" width, 3 mil minimum thickness.

2.5 CONTROLS EQUIPMENT LABELS

- A. Each controls device or major controls equipment shall be labeled to match controls drawings. This should include thermostats, switches, sensors, controllers, panels and other similar equipment.

1. Equipment labels - Self-Adhesive, Engraved, Laminated Phenolic Label: Adhesive backed, with black letters on a white background. Minimum letter height shall be 3/8 inch.
2. Device labels - Marker Tape: Self-laminating, clear polyester, 3/8" high tape with black lettering.

B.

2.6 ACCEPTABLE MANUFACTURERS

- A. Labels, markings and tags shall be manufactured by:
1. W.H. Brady
 2. Seton
 3. Allen
 4. Industrial Safety Supply

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification marking and tagging shall be applied after insulation and painting has been completed.
- B. Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled on drawings.
- C. The Plumbing, Fire Suppression and HVAC Contractors shall coordinate labeling, marking and tagging to attain coordinated and consistent systems of identification.
- D. Equipment labeling shall consist of unit designation as shown on the drawings. Exhaust labeling shall also indicate service of room or area of service.
- E. Pipe and duct markers shall be placed at 25 ft. centers in mechanical rooms and concealed spaces and at 50 ft. centers in other exposed locations.
- F. Refer to appropriate sections of this specification for installation of underground line marker tape.
- G. Valve tags shall be placed on each valve except those intended for isolation of individual items of equipment. Valve tag schedules shall be prepared as specified above.

END OF SECTION 23 0553

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SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes TAB to produce design objectives for the following:
 - 1. Air Systems:
 - a. Variable-air-volume systems.
 - 2. Hydronic Piping Systems:
 - a. Constant-flow systems.
 - b. Variable-flow systems.
 - 3. HVAC equipment quantitative-performance settings.
 - 4. Existing systems TAB.
 - 5. Verifying that automatic control devices are functioning properly.
 - 6. Reporting results of activities and procedures specified in this Section.

1.2 SUBMITTALS

- A. Strategies and Procedures Plan: Within 60 days from Contractor's Notice to Proceed, submit 6 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- B. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

1.3 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.4 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by AABC or NEBB.
- B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

- C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems." NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems." SMACNA's TABB "HVAC Systems - Testing, Adjusting, and Balancing."
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1.
- E. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.5 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.6 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

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.
 - 1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

- D. Examine system and equipment test reports.
- E. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- F. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- G. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- H. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.
- I. Examine strainers for clean screens and proper perforations.
- J. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine system pumps to ensure absence of entrained air in the suction piping.
- M. Examine equipment for installation and for properly operating safety interlocks and controls.
- N. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
 - 5. Sequence of operation for control modes is according to the Contract Documents.
 - 6. Controller set points are set at indicated values.
 - 7. Interlocked systems are operating.
 - 8. Changeover from heating to cooling mode occurs according to indicated values.
- O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.

- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 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 Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" SMACNA's TABB "HVAC Systems - Testing, Adjusting, and Balancing" and this Section.
 - 1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling unit components.
- L. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 - 1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
 - 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 - 3. Measure total system airflow. Adjust to within indicated airflow.
 - 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
 - 5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
 - 6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
 - 7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
 - 8. Record the final fan performance data.

- C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Balance systems similar to constant-volume air systems.
 2. Set terminal units and supply fan at full-airflow condition.
 3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
 4. Readjust fan airflow for final maximum readings.
 5. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
 6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
 7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
 8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
- D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
 2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
 3. Set terminal units at full-airflow condition.
 4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
 5. Adjust terminal units for minimum airflow.
 6. Measure static pressure at the sensor.
 7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.

- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
1. Open all manual valves for maximum flow.
 2. Check expansion tank liquid level.
 3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
 4. Check flow-control valves for specified sequence of operation and set at indicated flow.
 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
 6. Set system controls so automatic valves are wide open to heat exchangers.
 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.7 PROCEDURES FOR HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:
1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 4. Report flow rates that are not within plus or minus 5 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
1. Determine the balancing station with the highest percentage over indicated flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 3. Record settings and mark balancing devices.

- F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.8 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.9 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer, model, and serial numbers.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.10 PROCEDURES FOR CHILLERS

- A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:
 - 1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
 - 2. If water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
 - 3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
 - 4. Power factor if factory-installed instrumentation is furnished for measuring kilowatt.
 - 5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatt.
 - 6. Capacity: Calculate in tons of cooling.
 - 7. If air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.11 PROCEDURES FOR BOILERS

- A. If hydronic, measure entering- and leaving-water temperatures and water flow.
- B. Ensure primary pump operation with boiler.

3.12 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Water Coils: Measure the following data for each coil:
 - 1. Entering- and leaving-water temperature.
 - 2. Water flow rate.
 - 3. Water pressure drop.
 - 4. Dry-bulb temperature of entering and leaving air.
 - 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 - 6. Airflow.
 - 7. Air pressure drop.

3.13 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

3.14 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.

- I. Check main control supply-air pressure and observe compressor and dryer operations.
- J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.15 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 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.
 - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
 - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.16 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of TAB firm.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB firm who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer, type size, and fittings.
14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.

END OF SECTION 23 0593

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SECTION 23 0713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Fiberglass.
2. Protective Jacketing

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

A. Product Data:

1. For each type of product indicated.
2. Thickness and covering table.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

2.2 INSULATION MATERIALS

- A. Refer to 'Ductwork Insulation Schedule'.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be done by tradesmen specializing in insulation work in strict accordance with the manufacturer's recommendations.
- B. Ductwork shall be sealed prior to installation of insulation.
- C. Insulation shall be marked with manufacturer, "R-Value", and flame spread and smoke development.
- D. Blanket insulation shall be wrapped tight to the duct. Insulation shall be secured to ducts 20" wide and greater with weld pins and fasteners, 18" on center maximum. Adhesives shall be applied to the duct as an aid to installation and adhesion. Vapor barrier jacket shall be lapped, stapled and sealed with adhesive and 3" wide FSK pressure sensitive tape.
- E. Board insulation with factory applied jacket shall be secured to the duct with weld pins and fasteners, 12" on center maximum. Vapor barrier jacket shall be lapped, stapled and sealed with adhesive and 3" wide ASJ pressure sensitive tape.
- F. Ductwork which is internally lined with acoustic insulation, flexible ductwork with factory applied insulation and fiberglass ductwork need not be further insulated. Required internal lining is shown on the drawings. Refer to Section 23 3113 Ductwork and coordinate with the various trades.
- G. Equipment and devices in supply ductwork which could potentially condense moisture shall be insulated. This includes but is not limited to duct coils, reheat box coils, air control dampers and valves, fire dampers, smoke dampers.
- H. Reinsulate existing ductwork where existing insulation has been damaged or removed in the performance of work in this project.
- I. All exposed insulation shall be painted to match base material colors.

END OF SECTION 23 0719

SECTION 23 0716 – EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Fiberglass.
 - b. Foam Plastic.
2. Protective Jacketing

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

A. Product Data:

1. For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Thicknesses shall follow ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 INSULATION GENERAL

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

2.2 FIBERGLASS INSULATION

- A. Fiberglass board – 3 p.s.f. semi-rigid board with factory applied “all service” jacket.
- B. Fiberglass pipe insulation – tubular with factory applied “all service” jacket with overlapping longitudinal joints with integral seal.
- C. Vapor barrier jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches.
- D. Manufactures:
 - 1. Johns Manville Corporation
 - 2. Owens Corning Corp.
 - 3. Knauf Fiber Glass
 - 4. Manson

2.3 FOAM PLASTIC

- A. Flexible closed cell foamed elastomeric insulation applied with an air dried, contact adhesive compatible with insulation.
- B. Manufacturers:
 - 1. Armstrong
 - 2. Rubatex
 - 3. Armacell International

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fiberglass board insulation shall be secured with weld pins and fasteners, 12" on center maximum, and joints sealed with 3" wide ASJ pressure sensitive tape. Tank ends shall be blocked in with insulation, pinned, and finished with glass lagging cloth and mastic.
- B. Fiberglass pipe insulation shall be applied with sealed overlapping longitudinal joints and, if necessary, secured with staples and mastic. Butt joints shall be sealed with 3" wide ASJ pressure sensitive tape.
- C. Foam plastic insulation shall be held in place with adhesive. All joints shall be sealed with a vapor tight mastic. Insulation on removable chiller water boxes and heads shall be contained in a galvanized steel metal protective housing designed for easy removal.
- D. Aluminum protective jacket, where specified below, shall be 0.016" thick sheet wrapped around the item of equipment / tank / breeching and secured with bands. Jacket shall be applied to sides only, not the ends, of tanks and vessels. Finish cement and lagging cloth may be omitted where the jacket is applied.

3.2 SCHEDULE

- A. Water chiller surfaces not factory insulated which, in operation, will be cold (evaporator tank heads, piping, etc.).
 - 1. 1" thickness foam plastic insulation.
- B. Chilled water pump casings.
 - 1. 1" thickness foam plastic insulation or
 - 2. 2" thickness fiberglass board insulation.
- C. Chilled water storage tanks.
 - 1. 1" thickness foam plastic insulation
 - 2. 2" thickness fiberglass board for fiberglass pipe insulation.
- D. Large hot and chilled water air/dirt eliminator fittings similar to B&G "Rolairtrol".
 - 1. 1" thickness fiberglass board insulation
 - 2. 1" thickness foam plastic insulation.

END OF SECTION 23 0716

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SECTION 23 0719 - PIPE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Fiberglass.
 - b. Flexible Elastomeric.
 - c. Foamglas.
 - d. Foam Plastic.
2. Protective Jacketing

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

A. Product Data:

1. For each type of product indicated.
2. Thickness and covering table.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Insulation thicknesses shall follow the most current version of ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 INSULATION GENERAL

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- C. Refer to "Pipe Hanger Detail" on drawings for required hanger components.

2.2 INSULATION MATERIALS

- A. Refer to 'Pipe Insulation Schedule' on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be done by tradesmen specializing in insulation work in strict accordance with the manufacturer's recommendations.
- B. Overlap and seal all longitudinal joints. Staples and adhesives may be used as stated above. Tape and seal cross joints. Vapor barrier shall be continuous on insulation of all cold services. Vapor barrier type mastic shall be used where needed to maintain a vapor seal.
- C. Where insulation is terminated, insulation shall be beveled at 45° and the beveled surface sealed with vapor barrier mastic. PVC caps over straight cut ends which have been vapor sealed may be used in lieu of beveling.
- D. Mechanical joint fittings and couplings shall be considered as a part of the pipeline and shall be insulated. Bidders on the insulation work are cautioned to verify during the bidding period the extent of this work.
- E. Insulation shall be run continuously through wall penetrations. Insulation on cold service piping shall be run through floor and wall sleeves to maintain vapor barrier continuity. Insulation on other services may likewise be run continuous when sleeve size permits. Refer to the Piping Material and Methods Section for special considerations which must be given at fire-rated wall and floor penetrations. Refer to Section 230529 - Pipe Hangers and Supports for non-compressible insulation or blocking material and sheet metal saddles required at pipe hangers. Coordinate with the piping contractor on the furnishing, installation and detailed requirements of these. Provide insulation and vapor barrier on and around supports for pipe risers of services which require vapor seal so as to prevent sweating.
- F. Vertical pipe supports shall attach directly to pipe. Insulate support and all other surfaces with flexible closed cell insulation, same thickness as system insulation on cold service pipes to prevent condensation.

- G. Re-insulate piping where existing insulation has been damaged or removed in the performance of work in this project.
- H. Verify that piping has been tested before applying insulation materials and that piping surfaces are clean and dry, with foreign material removed.
- I. Fittings, valves, flanges and other devices, both exposed and concealed, requiring insulation shall be covered with the same thickness as pipe insulation with:
 - 1. Factory molded fitting insulation cover with PVC one-piece fitting cover.
 - 2. Miter-cut segments of pipe insulation, held in place with adhesive and/or wire, filled with insulating cement smoothed to shape and covered with PVC one-piece fitting cover.
 - 3. Fiberglass blanket insulation, held in place and covered with PVC one-piece fitting cover.
 - 4. Oversized pipe insulation, where applicable, finished same as straight run pipe insulation.
- J. Insulation is to be omitted on:
 - 1. Hot water valves, devices, specialties and related items, 2" size and smaller.
 - 2. Hot water piping in cabinetry of unit heaters and cabinet unit heaters
 - 3. Hot water piping between the coil and control valve when the control valve is located within 4 feet of the coil and the pipe size is 1" or less.
 - 4. Blow-down piping and safety relief valve discharge piping.

END OF SECTION 23 0719

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SECTION 23 800 – HVAC COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

- A. The Owner has contracted separately with a Commissioning Agent independent from the Architect, Engineer and Contractors. The Commissioning Agent shall be responsible solely to the Owner and shall act as an agent to the Owner in reviewing the quality of the project. The Commissioning Agent shall, through the Owner, have the authority to direct the Contractors to perform corrective work until final acceptance of the project by the Owner.
- B. The purpose of the commissioning is to verify that the building systems have been designed and installed to meet the Owner's requirements and operate per the design intent. Commissioning does not eliminate or reduce the contractor's responsibility to provide a complete and functional systems.
- C. The HVAC contractor shall participate in the commissioning process and provide adequate personnel to do so.
 - 1. Fire-rated insulation systems.

1.2 RELATED DOCUMENTS

- A. Section 01 9113 – General Commissioning Requirements
 - 1. The above section supplements this section such requirements listed in both are the responsibility of the HVAC Contractor.

1.3 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.4 HVAC SYSTEMS / EQUIPMENT INCLUDED IN THE COMMISSIONING PROCESS

- A. The following HVAC Systems shall be commissioned.
 - 1. Air Handler
 - 2. Boilers
 - 3. Air Cooled Chiller
 - 4. Pumps
 - 5. Terminal Units
 - 6. Exhaust Fans
 - 7. DDC Controls

PART 2 - COMMISSIONING PLAN

2.1 PRE-FUNCTIONAL TESTING / START UP

- A. The Commissioning Agent will provide pre-functional checklists. The installing contractor will complete the pre-functional checklist and the Manufacturer's start-up checklist for each piece of equipment prior to functional testing.
- B. Startup of major HVAC equipment will be witnessed by the Commissioning Agent. The contractor shall provide a minimum of 72 hours' notice to the Commissioning Agent prior to equipment start up. The appropriate contractors and or manufacturer's representative will be required to be on site to perform start up.

2.2 TAB MONITORING

- A. A Testing And Balancing (TAB) report approved by the engineer will be required before functional testing begins. The Commissioning Agent will periodically review the TAB procedures and randomly test measurements.
- B. The TAB contractor shall be available to the Commissioning Agent for a minimum of 8 hours to assist with the spot checks of each system after balancing is complete. The spot checks will include both air and water balancing. The TAB contractor shall use the same instruments for spot checking as were used for the balancing.

2.3 FUNCTIONAL TESTING

- A. The Commissioning Agent will perform or witness the installing contractor or manufacturer's representative performing functional testing.
- B. Each major system will be tested, and random sub-systems will be tested.

2.4 ISSUE LOG

- A. All deficiencies noted during the commissioning process will be documented in the master issues log.
- B. Contractors shall be responsible for correcting deficiencies and providing written responses to the Commissioning Agent listing the date and resolution. If a deficiency is not corrected the contractor shall provide an explanation as to why it was not corrected.
- C. Participation in the commissioning process is the contractor's responsibility. Unresolved issues or failure to provide responses to the Issue Log may be considered during the pay application approval process.
- D. The status of all items on the issue log will be updated and tracked by the Commissioning Agent.

- E. The Commissioning Agent will perform limited rechecks of items on the issues log after the contractor has provided written confirmation that corrections are complete. The cost of subsequent rechecks, if necessary, will be charged directly to the appropriate contractor at the hourly rate of the Commissioning Agent.

2.5 WARRANTY REVIEW

- A. The Commissioning Agent will return to the site approximately one month prior to the end of the warranty period to review outstanding issues and review system operation. The Commissioning Agent will assist the facility staff in developing reports and requests for services to remedy outstanding problems.

PART 3 - EXECUTION

3.1 RESPONSIBILITY OF HVAC AND TEMPERATURE CONTROL CONTRACTOR

- A. The contractor shall provide the Commissioning Agent assistance as necessary to gain access to the construction site for the purpose of verifying the installation of equipment and materials is performed in accordance with the contract documents. This shall include the use of keys, ladders, power lifts and other specialized equipment where needed.
- B. Assure participation of major equipment manufacturers in appropriate start up, training, and testing activities.
- C. Participate in commissioning meetings scheduled by the Commissioning Agent or the Construction Manager.
- D. Complete pre-functional checklists for review by the Commissioning Agent.
- E. Assist the Commissioning Agent as needed during the functional testing.
- F. Provide access to software and hardware of the DDC control equipment to the Commissioning Agent.
 - 1. The Automatic Temperature Control Contractor (ATC) shall provide the Commissioning Agent with full access to the Direct Digital Control (DDC) system software and hardware. The contractor shall provide the Commissioning Agent with a complete set of keys, and a copy of all software, along with sufficient training to allow the Commissioning Agent to enter the programs at the highest level of password and to perform the functional testing unassisted. The contractor shall load the software on a Portable Computer provided by the Commissioning Agent. The contractor shall provide the Commissioning Agent with a copy of all diagnostic and testing software and all necessary LAN interface attachments required to attach the Commissioning Agent's portable computer to all of the contractor's field panels or local area network hubs. The contractor shall make available the necessary software and hardware to the Commissioning Agent for a period beginning at the start of the installation and ending one year after the date of substantial completion of the project, including all updates as required to be 100% compatible with the installed DDC controls. The Commissioning Agent agrees to sign a licensing or confidentiality agreement;

however, the software and hardware shall be provided free of charge. The software will be deleted from the Commissioning Agents computer at the end of this one-year period. In lieu of the above requirement, the ATC may provide a laptop computer with the above-mentioned connection cable and software, for the Commissioning Agent's use during the period of on-site functional testing. This laptop computer will be returned at the completion of the functional testing but will be made available to the Commissioning Agent for a period of one year for retesting, opposite-season testing, and warranty checks.

G. Remote Access

1. The ATC shall provide a means to access the control system via internet connection. The contractor shall provide the Commissioning Agent with a copy of any software required to access the system at the highest password level from a remote site for the purpose of data acquisition. The remote capabilities shall include the ability to start trend logs, to retrieve trend data, and to convert data to Microsoft Excel files for graphic analysis. The Commissioning Agent shall provide internet access and computer at his location for remote access.

H. Participate in seasonal testing as required.

I. Provide owner training per the project specifications

J. The contractor shall submit to the Commissioning Agent the following information for all facility equipment and materials. This information will be used to create the facility maintenance plan.

1. Manufacturer
2. Supplier
3. Model
4. Serial Number
5. Replacement Cost
6. Warranty Start Date
7. Warranty Duration
8. Belt Sizes and Quantities (if applicable)
9. Filter Sizes and Quantities (if applicable)

K. It is the responsibility of each contractor to complete all equipment setup, testing, calibration, loop tuning, and related functions prior to commissioning. The contractor shall complete all the required checklists and certify in writing that these tasks have been accomplished and the systems are ready for commissioning.

L. The Mechanical and Controls Contractors shall assist the Commissioning Agent as necessary for the purpose of verifying the performance of the HVAC and Temperature Controls systems. The contractor shall assist the demonstration of the operation of all pieces of equipment throughout the equipment operational ranges, demonstrate all operating and control functions, safety devices, and other appurtenances as requested by the Commissioning Agent during the period scheduled for commissioning of the system and equipment. The contractors shall tune, repair, replace, calibrate, or otherwise modify all equipment that fails to meet the performance required by the contract documents as directed by the Commissioning Agent at no additional cost to the Owner.

END OF SECTION 23 0800

SECTION 23 0913 - INSTRUMENTS AND CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes instruments and control devices for HVAC Direct Digital Control (DDC) systems and components.
 - 1. Electronic Sensors
 - a. Thermistor Temperature Sensors & Transmitters
 - b. Humidity Sensors
 - c. Pressure Transmitters & Transducers
 - 2. Status Sensors
 - 3. Thermostats
 - 4. Humidistats
 - 5. Actuators
 - 6. Control Valves
 - 7. Dampers
- B. Related Sections:
 - 1. Section 23 0914 – Control Wiring and Cabling
 - 2. Section 23 0923 – Direct Digital Control System
 - 3. Section 23 0950 – Variable Frequency Motor Controllers

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each control component indicated.
- B. Shop Drawings:
 - 1. Each component shall be labeled for proposed usage and its corresponding item tag per the control drawing, diagram and sequence of operation submittal.
 - 2. Damper schedule.
 - 3. Valve schedule.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Where a list of manufacturers is not provided, products offered by the controls system contractor or their preferred vendor may be incorporated, subject to compliance with the specification.
- B. Where a list of manufacturers is provided under components below, the product shall be selected only from the list of manufacturers provided.

2.2 CONTROL SYSTEM COMPONENTS

- A. Refer to Section 23 0923 "Direct Digital Control System" for manufacturers and specifications for the DDC system, including operator workstation, distributed controllers, network requirements, accessories, control software and graphic requirements.
- B. Refer to Section 23 0914 "Control Wiring and Cabling" for power wiring, control cabling, transformers, fusing power distribution cabinets and power line filtering for the DDC system.
- C. Control system components specified in this Section include sensors, detection equipment, indicators, thermostats, humidistats, air flow measuring stations, meters, actuators, control valves and dampers.

2.3 SENSORS AND TRANSMITTERS

- A. Binary Temperature Devices
 - 1. Low Voltage space thermostat shall be 24V, bimetal-operated type with either adjustable or fixed anticipation heater. Provide subbase with manual or automatic switching as required to perform the specified functions.
 - a. Concealed Set Point adjustment
 - b. 55 Deg F to 85 deg F setpoint range
 - c. 2 Deg F maximum differential
 - d. Vented ABS plastic cover
 - e. Single or Multi-stage or modulating as required.
 - 2. Line Voltage space thermostat shall be bimetal-actuated, open contact or bellows actuated. Provide subbase with manual or automatic switching as required to perform the specified functions.
 - a. Enclosed snap-switch type, or equivalent solid-state type

- b. Heat anticipator
 - c. UL Listed for electrical rating
 - d. Concealed Set Point adjustment
 - e. 55 Deg F to 85 Deg F setpoint range
 - f. 1 Deg F maximum differential
 - g. Vented ABS plastic cover
 - h. Single or Multi-stage or modulating as required.
3. Low-Limit Thermostats. Low limit airstream thermostats shall be UL listed, vapor pressure type with an element 20-foot minimum length. Element shall cover the face of the coil at 1-foot centers and shall respond to the lowest temperature sensed by any 1-foot section. When one low limit stat cannot meet this requirement, provide multiple thermostats.
- a. Low Limit Thermostat shall be manually reset.
 - b. Provided with one (1) set of normally closed contacts wired directly to the fan circuit.
 - c. Provide with one (1) set of normally open contacts to provide an alarm to the DDC system.

B. Temperature Sensors

1. General

- a. Temperature sensors shall be thermistors or Resistance Temperature Device (RTD) and be suitable for the application. Where feasible, provide the same sensor type throughout the project. Avoid using transmitters unless necessary and approved by the engineer.
- b. Precision thermistors may be used in applications below 200 deg F. Sensor accuracy over the application range shall be 0.36 Deg F or less between 32 to 150 Deg F.
- c. Provide RTD sensors with platinum elements compatible with the digital controllers. Encapsulate sensors in epoxy, series 300 stainless steel, anodized aluminum, or copper. Temperature sensor accuracy shall be 0.1 percent (1 ohm) of expected ohms (1000 ohms) at 32 degrees F. Temperature sensor stability error over five years shall not exceed 0.25 degree F cumulative. Direct connection of RTD's to digital controllers without transmitters is preferred. When RTDs are connected directly, lead resistance error shall be less than 0.25 degrees F. The total error for a RTD circuit shall not exceed 0.5 degrees F.
- d. Provide matched temperature sensors for differential temperature measurement.

2. Duct Sensors

- a. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5m (5 feet) in length per 1m (10 sq ft) of duct cross section.
- b. Mixed air and Discharge air sensors shall be averaging type.

3. Immersion Sensors

- a. Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed. The well must withstand the flow velocities in the pipe.
 4. Space Sensors
 - a. Space sensors shall be equipped with a setpoint adjustment, occupancy mode override switch, display, and communication port. Sensor cover shall be rectangular high impact ABS plastic in a neutral color.
 5. Outdoor Sensors
 - a. Outdoor temperature sensors shall be platinum type and have a minimum accuracy of +/- 0.5 degrees F from -40 degrees F to 140 degrees F, and measuring range from -20 degrees F to 120 degrees F. Outdoor temperature sensor shall be within a ventilated enclosure that protects the sensor from thermal building mass biasing, solar radiation and precipitation without affecting performance.
- C. Humidity Sensors
 1. Duct and room sensors shall have a sensing range of 10% to 90%. Accuracy shall be +/- 3% of range.
 2. Duct sensors shall be provided with a sampling chamber.
 3. Outdoor air humidity sensors shall have a sensing range of 0% to 100% RH. Accuracy shall be +/- 5% of range. They shall be suitable for ambient conditions of -40 degrees F to 170 degrees F. Outdoor humidity sensor shall be within a ventilated enclosure that protects the sensor from thermal building mass biasing, solar radiation and precipitation without affecting performance.
 4. Humidity sensors drift shall not exceed 1% of full scale per year.
- D. Flow Switches
 1. Flow-proving switches shall be either paddle or differential pressure type.
 2. Paddle type switches (water service only) shall be UL Listed, SPDT snap-acting with pilot duty rating (125 VA minimum). Adjustable sensitivity with NEMA enclosure suitable for location.
 3. Differential pressure type switches (air or water service) shall be UL Listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA enclosure suitable for location, with scale range and differential suitable for intended application, or as specified.
- E. Relays
 1. Control relays shall be UL Listed plug-in type with dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for the application.

2. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable $\pm 200\%$ (minimum) from setpoint shown on plans. Contact rating, configuration, and coil voltage shall be suitable for the application. Provide NEMA enclosure suitable for location when not installed in local control panel.

F. Override Timers

1. Override timers shall be electronic or spring-wound line voltage UL Listed, with contact rating and configuration as required by the application. Provide 0 to 6 hour calibrated dial for spring-wound type or LCD display for electronic type unless otherwise specified. Timer shall be suitable for flush mounting on control panel face and or wall as shown.
2. Push button with D.O. and lighted button

G. Current Transformers

1. AC current transformers shall be UL/CSA recognized and completely encased (except for terminals) in approved plastic material.
2. Transformers shall be available in various current ratios and shall be selected for $\pm 1\%$ accuracy at 5 A full scale output.
3. Transformers shall be split-core type for installation on new or existing wiring.

H. Voltage Transmitters

1. AC voltage transmitter shall be self-powered single loop (two-wire) type, 4 to 20 mA output with zero and span adjustment.
2. Ranges shall include 100 to 130 VAC, 200 to 250 VAC, 250 to 300 VAC, and 400 to 600 VAC full-scale, adjustable, with $1\% \pm$ full-scale accuracy with 500 ohm maximum burden.
3. Transmitters shall be UL/CSA recognized at 600 VAC rating and meet or exceed ANSI/ISA S50.1 requirements.

I. Voltage Transformers

1. AC voltage transformers shall be UL/CSA recognized, 600 VAC rated, complete with built-in fuse protection.
2. Transformers shall be suitable for ambient temperatures of 40 to 130 degrees F, and shall provide $\pm 0.5\%$ accuracy at 24 VAC and a 5VA load.
3. Windings (except for terminals) shall be completely enclosed with metal or plastic material.

J. Surge and Transient Protection

1. Provide each digital controller with surge and transient power protection. Surge and transient protection shall consist of the following devices, installed externally to the controllers.
2. Power Line Surge Protection
 - a. Provide surge suppressors on the incoming power at each controller or grouped terminal controllers. Surge suppressors shall be rated in accordance with UL 1449, have a fault indicating light, and conform to the following.
 - 1) The device shall be a transient voltage surge suppressor, hard-wire type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.
 - 2) The device shall react within 5 nanoseconds and automatically reset.
 - 3) The voltage protection threshold, line to neutral, shall be no more than 211 volts.
 - 4) The devices shall have an independent secondary stage equal to or greater than the primary stage joule rating.
 - 5) The primary suppression system components shall be pure silicon avalanche diodes.
 - 6) The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.
 - 7) The device shall have an indication light to indicate the protection components are functioning.
 - 8) All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.
 - 9) The device shall have an EMI/RFI noise filter with a minimum attenuation of 13dB at 100 kHz to 300 MHz.
 - 10) The device shall comply with IEEE C62.41, Class "B" requirements and shall be tested according to IEEE C62.45.
 - 11) The device shall be capable of operating between -20 degrees F and +122 degrees F.
3. Telephone and Communications Line Surge Protection
 - a. Provide surge and transient protection for DDC controllers and DDC network related devices connected to phone and network communication lines, in accordance with the following:
 - 1) The device shall provide continuous, non-interrupting protection, and shall automatically reset after safely eliminating transient surges.
 - 2) The protection shall react within 5 nanoseconds using only solid-state silicon avalanche technology.
 - 3) The device shall be installed at the distance recommended by its manufacturer.
4. Controller Input/Output Protection
 - a. Provide controller inputs and outputs with surge protection via optical isolation, metal oxide varistors (MOV), or silicon avalanche devices. Fuses are not permitted for surge protection.

K. Current Switches

1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

L. Water Flow Meters

1. Water flow meters shall be insertion electromagnetic type which provide current and voltage analog output for a flow rate, a high-resolution frequency output drive to peripheral devices, a scalable pulse output for totalization, and a master alarm signal.
2. Materials: Wetted metal components shall be 316 Stainless Steel. Sensor head shall be XAREC.
3. Liquid temperature range: 15 deg F to 250 deg F.
4. Ambient Temperature range: -20 deg F to 150 deg F.
5. Max. Operating pressure: 400 psi.
6. Pressure Drop: 0.1 psi at 12 ft/sec in 3" pipe, decreasing as line size increases.
7. Accuracy shall be +/- 1% of reading from 2 – 20 ft/sec, and +/- 0.02 ft/sec below 2 ft/sec.
8. Analog Output – One (1) 4-20 ma, and one (1) 0-10 V or 0-5 V.
9. Frequency Output – 0-15 V peak pulse, 0-500 Hz.
10. Scalable Output – Isolated solid-state dry contact, rated at 30 V at 1.2 A, pulse duration 0.5, 1, 2 or 6 seconds.
11. Electronics Enclosure – Weathertight NEMA 4 aluminum enclosure.
12. Onicon Model FT-3400 series or approved equal.

M. Pressure Transducers

1. Transducers shall have a linear output signal. Zero and span shall be field-adjustable.
2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than the calibrated span without damage.
3. Water pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Transducer shall be complete with 1 – 5 Vdc or 4 to 20 mA output, required mounting brackets, and block and bleed valves.
4. Water differential pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (differential pressure) and

maximum static pressure shall be 300 psi. Transducer shall be complete with 1 – 5 Vdc or 4 to 20 mA output, required mounting brackets, and five-valve manifold.

5. Air velocity pressure sensors shall use differential pressure to determine airflow rate and have repeatability within 1% of reading and an accuracy of +/- 5% of range. The velocity range shall be from 0 to 3250 FPM.
- N. Differential pressure type switches (air or water service) shall be UL Listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application.

O. AIR FLOW MEASURING STATIONS

1. The probe assembly shall consist of one or more electronic air flow measuring units capable of continuously monitoring airflow. Each probe shall contain multiple electronic flow sensors and be thermal dispersion type. They shall be mounted in an array format to produce a true velocity profile. The sensors shall operate over a 350 to 7500 fpm velocity range and the velocity measured by each sensor shall output a signal directly proportional to flow to the supporting electronics. The output signal shall be fully isolated. The signal transmitter shall be an electronic device capable of receiving airflow probe signals over the probe interconnecting cables, linearizing each signal and then summing and averaging them. Finally, the signals shall be converted to a 4 to 20 MA output signal for automatic transmission to any suitable remote input and/or recording device. A 24 volt AC power supply is required for each transmitter. The control panel shall be provided with integral diagnostics including on-line zero and on-line sensor verification. It shall have an integral reference standard for field calibration of transmitter output. The output span shall be adjustable from a minimum 0 to 1000 to a maximum 7500 fpm. The transmitter assembly shall be housed in a metal enclosure having a hinged door and lock. This unit shall not require recalibration. System accuracy shall be +/- 2% of rate plus +/- 0.55 of full scale.
2. Each supply and return fan shall have an independent air flow measurement station. Multiple fan arrays shall sum flow of each fan to report a total fan array air flow.
3. The outdoor air intake damper shall have an independent air flow measuring station.
4. Air flow measuring station shall be manufactured by:
 - a. Ebtron Gold Series
 - b. Paragon Controls
 - c. Air Monitor
 - d. Tek-Air
 - e. Kurz

2.4 ACTUATORS

- A. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
 1. Manufacturers: Belimo Aircontrols (USA), Inc.

2. Listing: Actuators shall have ISO 9001 quality certification and be UL listed under standard 873.
3. Characteristics: Actuators shall be fully modulating/proportional, pulse width, floating/tri-state or two-position as required and be factory or field selectable. Each actuator shall have visual position indicators. Proportional actuators shall accept a 0-10VDC or 0-20mA input signal with 2-10VDC and 4-20mA operating range, respectively. Actuators shall be capable of operating on 24, 120 or 230VAC or 24VDC and Class 2 wiring as required by the application. Power consumption shall not exceed 10VA for 120V actuators and 8 watts for DC actuators. Actuators shall be capable of being mechanically and electrically parallel to increase torque if required
4. Fail-Safe Operation: Mechanical, spring-return mechanism shall be provided on all dampers and valves except where noted otherwise. Provide external, manual gear release on non-spring return actuators.
5. Valves: Size for torque required for valve close off at maximum pump differential pressure plus 25% safety factor.
6. Dampers: Size for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb./sq. ft. of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb./sq. ft. of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb./sq. ft. of damper.
 - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb./sq. ft. of damper.
 - e. Dampers with 2- to 3-Inch w.g. (of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
 - f. Dampers with 3- to 4-Inch w.g. of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
 - g. Coupling: V-bolt and V-shaped, toothed cradle.
7. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
8. Run Time: 12 seconds open, 5 seconds closed.

2.5 CONTROL VALVES

- A. Control Valves: Factory fabricated, of type, body material, and pressure class based on fluid system, maximum pressure and temperature rating of piping system, unless otherwise indicated.
- B. Valves shall be equipped with a manual positioner to allow positioning of the valve in the absence of power.
- C. Sizing – Hydronic system control valves shall be sized as follows:
 1. Two-Position: Line Size
 2. Two- or Three-Way Modulating: 10 ft. hd. water pressure drop or as otherwise noted on the plans.
- D. Ball Valves 2" and smaller

1. Body:
 - a. Cast Bronze or Brass
 - b. ANSI B16.5 Class 150
 - c. Threaded or soldered pipe connection
 2. Trim:
 - a. Stem: Stainless Steel
 - b. Ball: Stainless with an equal percentage flow characteristic or modified equal percentage flow characteristic for 2-way, linear for 3-way.
 3. Bonnet
 - a. Brass
 - b. Packing: Reinforced Teflon or carbon filled Teflon and EPDM O-Ring.
 - c. Seat: Reinforced Teflon or carbon filled Teflon.
- E. Butterfly Valves 2.5" – 12"
1. Body:
 - a. Cast Iron with extended neck or flange and insulation clearance.
 - b. Flanged with full lugged connections.
 2. Trim:
 - a. Stem: Stainless Steel
 - b. Disc: Stainless Steel, Nickel Plated Ductile Iron, or Ductile Iron coated with Nylon 11, equal percentage flow characteristics or modified equal percentage flow characteristics, bubble tight shut off.
 - c. Seat: EPDM
- F. Globe Valve 2" and Smaller
1. Body
 - a. ANSI B16.5 Class 125 and 250
 - b. Cast Bronze or Brass
 - c. Threaded (FNPT), union sweat, or flared connections
 2. Bonnet
 - a. Brass
 - b. Packing: Self-adjusting Ethylene Propylene Rubber (EPR) ring pack u-cups, spring loaded PTFE and Elastomer v-rings, or spring loaded Teflon cone.
 3. Brass Trim
 - a. Stem: Stainless Steel
 - b. Plug: Brass, equal percentage flow characteristic or modified equal percentage flow characteristic.
 - c. Replaceable Seat: Brass against molded Elastomeric disc, or bronze.
 4. Stainless Steel Trim (Steam Applications)
 - a. Stem: Stainless Steel
 - b. Plug: Brass, equal percentage flow characteristic or modified equal percentage flow characteristic.
 - c. Replaceable Seat: Stainless Steel.

G. Globe Valves 2.5" and Larger

1. Body
 - a. ANSI B16.5 Class 125 and 250
 - b. Cast Iron with black lacquer finish
 - c. Flanged Connections
2. Bonnet
 - a. Brass
 - b. Packing: Ethylene Propylene Terpolymer (EPT) ring packs, EDPM O-ring, or spring loaded Teflon cone.
3. Trim
 - a. Stem: 316 Stainless Steel
 - b. Plug: Brass, equal percentage flow characteristic or modified equal percentage flow characteristic.
 - c. Replaceable Seat: bronze.

H. Close-off Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings.

1. Water Valves:
 - a. Two-Way: 150% of total system pump head.
 - b. Three -Way: 300% of pressure differential between ports A and B at design flow rate or 100% of total system pump head.

2.6 DAMPERS

A. Dampers: AMCA-rated, parallel and opposed blade design as required by the application.

B. Outside air and relief air dampers (exposed to outside air) shall be severe cold option design with the following features:

1. Frame: Extruded aluminum, 4" x 0.08" thickness with polystyrofoam insulation.
2. Blades: Extruded aluminum, double wall profile with expanded polyurethane foam insulation filled cores and thermally broken. Insulation factor of R-2.29
3. Seals: Blade and frame edge seals are extruded silicon, secured in an integral slot.
4. Bearings: Celcon inner bearing fixed to a 7/16" aluminum hexagonal blade pin, rotating within a polycarbonate outer bearing without metal-to-metal or metal-to-plastic bearing contact.
5. Linkage: Hardware mounted within the frame, aluminum and zinc plated steel construction.
6. Operating temperature: -40 to 155°F.
7. Leakage: 4.9 cfm/sq. ft. at 4" w.g., maximum

C. Return and other control dampers not exposed to outside air shall be constructed with the following features:

1. Frame: Extruded aluminum, 5" x 0.125" thickness.
2. Blades: Extruded aluminum, airfoil profile.

3. Seals: Blade seals shall be extruded EPDM. Frame seals shall be extruded TPE thermoplastic, secured in an integral slot.
4. Bearings: Molded synthetic
5. Linkage: Hardware mounted within the frame, aluminum and zinc plated steel construction.
6. Operating temperature: -72 to 275°F.
7. Leakage: 3 cfm/sq. ft. at 1.0" w.g. max.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify location of wall mounted sensors with drawings and room details before installation. Install devices to match rough in height of light switches provided by the Electrical Contractor, Coordinate location and placement with other wall mounted devices, cabinets, etc.
- B. Room temperature sensors shall be installed on concealed metal junction boxes properly supported by the wall framing.
- C. Install averaging elements in ducts and plenums in a serpentine pattern.
- D. Low limit sensors shall be installed in a serpentine manner horizontally across the coil. Each bend shall be supported with a capillary clip. Provide 1 foot of sensing element for each 1 square foot of coil area.
- E. All pipe mounted sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.
- F. Install outdoor air temperature/humidity/enthalpy sensors on a north wall with a sun shield.
- G. Local control panels shall be provided for the equipment being controlled. The panel shall be mounted in the mechanical room with the equipment it serves. Mount panels on wall or independent support structure. Do not mount on equipment.
- H. Install guards on room temperature sensors and or thermostats in the following locations:
 1. Entrances.
 2. Public areas, such as lobbies.
 3. Corridors.
 4. Where indicated on drawings.
- I. Automatic dampers shall be furnished by the control's subcontractor, installed by the HVAC Contractor in accordance with Section 23 3300 "Air Duct Accessories."
- J. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- K. Damper linkages shall be through frame hardware; linkage attachments to blades are not acceptable.

- L. Damper jack shafting is not permitted, provide an actuator for each damper section.
- M. Identification of Hardware And Wiring:
 - a. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2" of termination, with the DDC address or termination number.
 - b. Permanently label or code each point/object of field terminal strips to show the instrument or item served.
 - c. Identify control panels with minimum ½" letters on laminated plastic nameplates.
 - d. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.
 - e. Identify room sensors relating to terminal units or valves with adhesive stickers.
 - f. All identifiers shall match the naming convention on the drawings and within the DDC graphics.

3.2 SCHEDULES

A. Control Valves

System Type	Valve Type(s) (Per 2.6)	Fail Position
AHU Chilled Water Coil – 2" & Smaller	Ball, Globe	Closed
AHU Chilled Water Coil – 2.5" & Larger	Globe	Closed
AHU Hot Water Coil – 2" & Smaller	Ball , Globe	Open
AHU Hot Water Coil – 2.5" & Larger	Globe	Open
VAV Terminal Unit	Ball	In-Position
Unit Heaters	Ball	In-Position
Minimum Flow Bypass – 2" & Smaller	Ball, Globe	Open

B. Damper Actuators

System Type	Fail Position
Outside Air	Closed
Exhaust Air	Closed
Return Air	Open
Supply Air	Open

END OF SECTION 23 0913

SECTION 23 0914 – CONTROL WIRING AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes control wiring, both line and low voltage, transformers, power distribution, fusing and panels, power filtering and communication cabling which is required to perform the automatic control functions described.
- B. Related Sections:
 - 1. 23 0913 Instruments and Control Devices
 - 2. 23 0923 Direct Digital Control System

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: 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. Wiring, both line and low voltage, shall comply with NEC and shall be subject to approval by the local code enforcing authorities.
- C. Wire, conduit and installation methods shall conform to applicable provisions of Division 26 - Electrical except that wiring smaller than No. 12 and conduit smaller than 3/4" are permitted as appropriate for the application.
- D. Communication cabling shall conform to applicable provisions of Division 27- Section "Communications Horizontal Cabling".
- E. All wiring and cabling insulation in air return plenums shall not exceed maximum flame spread rating of 25 and smoke development rating of 50 as established by NFPA 255 test methods.

PART 2 - PRODUCTS

- A. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
 - 1. Output ripple of 5.0 mV maximum peak to peak.

2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- B. Power Line Filtering: Provide internal or external transient voltage and surge suppression for workstations or controllers with the following:
1. Minimum dielectric strength of 1000 V.
 2. Maximum response time of 10 nanoseconds.
 3. Minimum transverse-mode noise attenuation of 65 dB.
 4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.
- C. Power distribution, fusing and panels:
1. Power distribution transformers, fuses, termination strips etc. shall be organized in NEMA 1 enclosure panels. Panels shall be 16 gauge steel construction, with removable front cover and various size removable knockouts, arranged for surface mounting and polyester powder coat finish inside and outside, UL listed. Arrange and bundle wiring inside of panels neatly with cable ties. Panel and internal devices shall be permanently marked to correspond to power wiring diagram shop drawings provided in the operating and maintenance manual.
- D. Cabling:
1. Provide CAT 5E Ethernet fiber optic cabling to interconnect major controllers and workstation computer or Web server to establish the primary network configuration as determined by the direct digital control system architecture. Provide excess cabling at each connection for servicing by looping cable near the panel.
 2. Secondary LON or BACnet MS/TP bus wiring to secondary controllers such as unitary controllers serving VAV boxes shall be as required by the communication protocol.
 3. All cable insulation shall be approved and labeled for use in air plenums when installed in these locations.

PART 3 - EXECUTION

3.1 ELECTRICAL POWER SUPPLIES

- A. The Electrical Contractor will provide a power source to motors through his starters only. Where power sources are required beyond these starters, or beyond sources explicitly shown on the electrical drawings, these shall be provided by the Controls Contractor. Where auxiliary contacts are required on starters to perform the required functions, these too shall be provided by the Controls Contractor, where not provided under the Electrical Contract. Auxiliary relays may be provided in lieu of auxiliary contacts.
- B. Circuits serving control panels, transformers for low voltage service, and other control equipment and devices shall be independent and used for no other purpose. These shall originate from the nearest appropriate emergency electrical panel. Circuit wiring from the

electrical panel shall be included in this contract. These circuits should be clearly identified at the panels.

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install all work in accordance with the following:
1. All wiring to be ran in a neat, workmanlike manner. All wiring to be tie wrapped or in conduit as per specifications. Wiring or conduit to be ran parallel or at right angles to building structure. Install all wiring free of sags. Bundle wiring together that follows a common path.
 2. All conduit, plenum wiring, and panels shall be supported directly from the building structure with beam clamps and bridle ring. Do not support from pipe, pipe hangers, threaded rod, ductwork, ductwork strapping or other conduit.
 3. Do not lay conduit or plenum wiring on acoustic ceiling tiles, grid members or uninsulated water piping. Conduit and wiring should be installed in such a way as to not interfere with removing ceiling tiles for above ceiling access.
 4. Do not run wiring near lighting ballasts or other high voltage devices that could cause interference.
 5. All line voltage wiring must be kept separate from low voltage wiring. Line and low voltage wiring may not be run in the same conduit. Line and low voltage wiring must be kept separate in control panels.
 6. Label all wire jackets at control panel/controller and at device with tag as shown on wiring details and flow diagrams.
 7. Observe proper polarity as shown on wiring diagrams when connecting 24VAC power and ground controllers and other devices. Note that all transformer secondary grounds must be tied to chassis ground as shown in wiring diagrams unless otherwise noted.
 8. Coordinate with General Contractor and all trades to perform rough-ins for temperature control sensors and devices.
 9. Coordinate with General Contractor and all trades to confirm mounting locations for temperature control panels.
 10. Completely seal all duct, unit and wall penetrations. Avoid ceiling penetrations if at all possible. Completely seal any ceiling penetrations that are absolutely necessary.
 11. All network communication wires shall be labeled at each controller with the designation or the controller that the communication wire originates from and terminates to
 12. Verify network communications and correct any issues.
 13. Clean all construction debris from inside temperature control panels before operation.
- B. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."
- C. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." All line voltage wiring and low voltage wiring (except as stated below) shall be run in conduit. Low voltage wiring concealed above accessible ceilings and in hollow walls for drops to thermostats may be run without conduit. Open wiring dropping into walls shall be run in conduit. Thermostats shall be installed on a single gang box and conduit shall be installed to extend into the plenum. Open wiring shall be bundled and supported at 3 ft. maximum intervals with a system of J-hooks or equivalent means. Open wiring in air plenums shall be rated for such use and so labeled.

- D. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."
1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
 2. Install exposed cable in raceway.
 3. Cabling concealed above accessible ceilings may be run without conduit. Cabling dropping into walls shall be run in conduit. Wall mounted sensors shall be installed on a single gang box and conduits shall be installed to extend to above an accessible ceiling location.
 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

END OF SECTION 23 0914

SECTION 23 0923 – DIRECT DIGITAL CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. A complete system of computer based, direct digital automatic temperature controls shall be installed under this contract as required to complete the sequence of control for various items of equipment and systems indicated on the drawings and as specified in Division 23.
- B. Direct Digital Controls (DDC) upgrade for the existing building controls is part of the scope of work. Refer to drawings for systems sequence of operations. Controllers, system architecture, communication cabling and network, software, graphics, etc. shall be seamlessly integrated as part of the new system.
- C. This Section includes Direct Digital Control (DDC) components, including operator workstation, controller/server, equipment specific and generic controllers, I/O interface, software and graphics.
- D. Related Sections –
 - 1. See Sections 23 0913 “Instruments and Control Devices”
 - 2. Section 23 0914 “Control Wiring and Cabling”
 - 3. Section 23 0993 “Sequence of Operations for Controls”

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For all hardware and software.
- B. Shop Drawings:
 - 1. Schematic air and fluid flow control diagrams.
 - 2. Sequence of operations descriptions and points list.
 - 3. Power, wiring diagrams.
 - 4. DDC System Hardware components, including controllers, actuators, sensors, valves, dampers, cabinet enclosures, wiring, misc. controls devices, etc.
 - 5. Control System Software
 - 6. Graphics – Screen examples specific to the project for:
 - a. Air handling unit and related devices and points.
 - b. Heating hot water system – Boilers, pumps and related devices.
 - c. Chilled water system – Chiller, pumps and related devices.

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- d. Exhaust fans & associated fume hoods & canopies.
 - e. VAV air terminal units.
 - f. Unit propeller and cabinet heaters.
7. Floor plans with air terminal unit and UH zones.

C. Software and firmware operational documentation.

D. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Each control subcontractor must be an authorized temperature control contractor in the business of installing and servicing direct digital temperature control systems for over five (5) years. The bidder must have installed and successfully completed at least ten (10) DDC systems of similar size using the same hardware that is proposed.
- B. The subcontractor's installation and service office must be located within 75 miles (90-minute travel time maximum) of the building site.
- C. The design and installation of the digital control system shall be performed by employees trained and certified by the equipment supplier. Electrical power work other than low voltage shall be performed by licensed electricians.
- D. The temperature controls subcontractor shall provide all necessary engineering support for a complete and functional system, including but not limited to engineering, programming, installation, supervision, commissioning and troubleshooting.
- E. Refer to 23 0801 Mechanical Systems Commissioning.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 CONTROL SYSTEM

- A. Contractors:
 - 1. Honeywell International Inc Authorized Controls Integrator (ACI) (local authorized contractors only, branch office is not acceptable)
 - 2. Schneider Electric – TAC I/A Series, EcoStruxure
 - 3. Automated Logic
 - 4. Alerton
 - 5. BuildingLogiX
 - 6. Ameresco – Distech Controls
 - 7. Trane Technologies – Symbio BACnet

- B. Complete DDC system shall consist of operator workstation, sensors, indicators, actuators, final control elements, interface equipment, wiring, cabling, power supplies and power distribution, other apparatus, accessories, software and graphics connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems as specified here and in related Division 23 Sections.

2.2 LICENSING AGREEMENT AND OPEN PROTOCOL

- A. A true Open Licensing Agreement shall be provided and executed with the Owner to permit total and open access to the system for servicing and software revisions by other qualified servicing contractors.
- B. The supplied system must incorporate open protocol with the ability to access all data using Java base Web enabled browsers without requiring proprietary operator interface and configuration programs.
- C. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a server. Proprietary database and user interface programs are not acceptable (except for unitary controllers as noted below).
- D. The computer software supplied shall employ object-oriented technology (OOT) for the representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-1995, BACnet and LonMark to assure interoperability between all present and future system components is required.
- E. Proprietary programming shall not be utilized. In addition, all required programming software and graphics shall be embedded in the server or controllers without the need for external software to execute queries or revisions. All graphics shall reside in the server. Remote access via LAN or Web shall not require external software to provide complete access to all data, graphics, alarms, programming, etc.

2.3 DDC ARCHITECTURE

- A. DDC system shall be complete with an Operators Workstation/Server, Configurable Controllers, Unitary Controllers, required I/O modules for controller expansion, communication cards in controlled devices such as chillers, variable frequency drives (furnished with the equipment, coordinate card requirements), arranged for a completely integrated building automation system network.
- B. Physical connection of BACnet network controllers shall be via Ethernet/Ethernet IP using the Owner's Local Area Network (LAN).
- C. Where data drops are not shown for the Configurable Controllers or Operator Station/Server, the temperature control subcontractor shall be responsible for providing the IP data drop to each network controller location for controller connectivity. Installation shall be subcontracted to the division 27 technology contractor: coordinate connection requirements. In addition, provide an

additional IP data drop to each controller, or group of controllers to provide local access to data acquisition for the HVAC service technician.

- D. All components and controllers supplied under this contract shall be true “peer-to-peer” communicating devices. Components or controllers requiring “polling” by a host to pass data shall not be acceptable.
- E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer’s internal Intranet network. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.
- F. DDC system accessibility over the LAN or the Internet shall be username and password protected. Provide separate username/password for multiple level hierarchy to restrict access to appropriate personnel at the different levels (view, programming, etc.). The system must be set up to have at least 3 access levels: guest, user and administrator. Guest privileges shall be limited to view only. Users shall be able to make setpoint and schedule changes. Administrators shall have all privileges as users in addition to being able to assign passwords.

2.4 OPERATOR WORKSTATION/SERVER

- A. An operator workstation/server shall be provided to effectively program, manage and access DDC information from all the controllers. Interface shall utilize dynamic color graphics of each mechanical system, building floor plan, and control device depicted by point-and-click graphics.
- B. All DDC information shall be accessible through the server over the LAN as well as over the Internet via Ethernet IP.
- C. Operator Workstation/Server Computer: Equal to Dell Studio XPS 630.
- D. Minimum Requirements (or equivalent):
 - 1. Processor: Intel Core 2 Duo.
 - 2. Ports/Jacks: (6) USB 2.0, (2) IEEE 1394a, headphone, microphone, 19-1 media reader, (1) RJ-45, 2.1 audio, S video in/out, S/PDIF optical
 - 3. Random-Access Memory: 2GB Dual Channel DDR2 SDRAM.
 - 4. Monitor: 20” wide screen, WSXGA resolution, 5ms pixel display rate, 720p high-definition display flat panel.
 - 5. Graphics: Intel GMA 3100
 - 6. Hard-Disk Drive: 160 GB.
 - 7. 48X combo optical drive.
 - 8. Communications: Integrated Gigabit Ethernet (10/100/1000Base-T), internal WiFi 802.11 a/b/g/n Draft 2.0
 - 9. 10W Stereo Speakers
 - 10. Operating System: Microsoft Windows
 - 11. Keyboard.
 - 12. Mouse: Three buttons, optical.

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13. Six outlet surge protectors.
 14. Printer: Laser jet type, B&W, 8Mb RAM equal to HP LaserJet 1022
 15. Workstation desk and chair will be provided with loose furnishings by others.
- E. The server should provide integrated control, supervision, data logging, alarming, scheduling and network management functions. The controller/server provides Internet connectivity and Web serving capabilities, presenting real time information in Web based, rich graphical displays for the system. Application control programs to provide: Calendar functions, Scheduling, Trending, Alarm monitoring and routing, and Time synchronization.
- F. Proprietary programming shall not be utilized. In addition, all required programming software shall be embedded in the server or controllers without the need for external software to execute queries or revisions. All graphics shall reside in the server. Remote access via LAN or Web shall not require external software to provide complete access to all data, graphics, alarms, programming, etc.
- G. The server should support standard Web browser access via the Intranet/Internet.
- H. Provide and maintain an Audit Log that tracks defined activities on the system. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached a user-defined buffer size. Archive the log locally. For each log entry, provide the following data: Time and date, User ID, Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.
- I. The controller/server shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval. Copies of the current database and the most recently saved database shall be stored in the server. The age of the most recently saved database is dependent on the user-defined database save interval. The controller/server database shall be formatted to allow for user viewing and editing, if desired.

2.5 CONFIGURABLE CONTROLLERS/SERVERS

- A. Individual JACE 9000 Niagara based configurable controllers shall be provided for each central HVAC equipment or system (AH unit, boiler, chiller, etc.). Distributed HVAC equipment, such as air control box terminals, fan coils, unit heaters, etc may utilize local, unit specific controllers.
- B. Controllers shall be capable of functioning in either a standalone capacity or integrated into the building network.
- C. Controllers shall be fully configurable type with both control and server capabilities including integrated control and management of external devices, supervision, data logging, alarming, scheduling, network management functions, Internet connectivity, web serving. The controller shall include software technology capable of integrating a variety of devices, interoperable networks and protocols such as LonWorks, BACnet, ModBus, etc into a seamless operating platform.

- D. The controllers shall be expandable using input/output I/O modules to provide additional points beyond resident points provided on the controller module.
- E. Each configurable controller shall include the following minimum hardware features. Where required for functionality provide additional communication cards, memory cards or I/O modules: Two (2) Ethernet Port -10/100 Mbps, One (1) RS-232 port, One (1) RS-485 ports (BACnet MS/TP), LON Tunnel service, BACnet driver (Ethernet and Ethernet IP), One LONWorks Interface Port with driver – 78KB FTT-10A, Power Supply 24V power supply module, Battery Backup, 64 Mb flash memory for long term data backup and 64 Mb RAM.
- F. I/O modules shall connect to the controller with a single multi pin plug, powered through the controller with a minimum of eight (8) universal inputs, four (4) analog outputs and four (4) relay outputs, Form A contacts. Do not exceed maximum I/O modules recommended by the manufacturer.
- G. The controller/server must be capable of operation over a temperature range of 0 to 50°C and storage temperatures of between 0 and 70°C. The controller/server must be capable of operation over a humidity range of 5 to 95% RH, non-condensing.
- H. The controller/server shall support standard Web browser access via the Intranet/Internet.
- I. Where acting as a server, provide and maintain an Audit Log that tracks all activities performed on the controller/server. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached it's user-defined buffer size. Provide the ability to archive the log locally (to the controller/server), to another controller/server on the network, or to a server. For each log entry, provide the following data: Time and date, User ID, Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.
- J. The controller/server shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval. Copies of the current database and, at the most recently saved database shall be stored in the controller/server. The age of the most recently saved database is dependent on the user-defined database save interval. The controller/server database shall be stored, at a minimum, in XML format to allow user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.
- K. Controllers shall be fully programmable with “drag and drop” graphic representations of control algorithms and easy to use “wizards” that automate controller configurations.
- L. Controllers shall be “Native” BACnet devices with interoperable native BACnet, IP, LON and MS/TP communication support.
- M. Each controller with I/O modules shall include input/output capabilities with, as a minimum, sufficient universal inputs, digital inputs, universal outputs and digital outputs to perform the required function and include an additional spare two (2) universal inputs, (2) analog outputs and two (2) relay outputs for future upgrade capability (spare points are not required for unitary controllers).

2.6 UNITARY CONTROLLERS

- A. Controller designed specifically for VAV reheat air terminal units, fan coil, unit heater, etc., shall be used for each distributed HVAC equipment item. Local controllers shall be capable of functioning in a standalone capacity but should be integrated into the building network.
- B. Use of a dedicated network with a proprietary communication protocol that is compatible for integration into the configurable controllers is acceptable provided the unitary controllers use true peer to peer communication for all devices, the communication network uses simple non polarity sensitive twisted pair wiring and the network provides for interoperability between devices and controllers such as Echelon LonWorks is acceptable.
- C. For VAV reheat air terminal units:
 - 1. The controller shall include, where required, a digital communication to:
 - 2. The remote, space temperature and/or humidity wall sensor,
 - a. The remote wall sensor shall include a communication jack for connecting a laptop to the terminal unit controller for air/water balance purposes.
 - 3. Velocity pressure pneumatic input via polyethylene tubing for supply air flow reading,
 - 4. Supply air flow sensor,
 - 5. Flow balancing software (damper adjustment, set point monitoring and adjustment, flow validation and calibration, sequence/calibration/control set point logs)
 - a. Terminal unit supply air temperature sensor
 - 6. Damper actuators shall be separate from the VAV reheat box controller; integrated controller/actuator devices are not acceptable.
 - 7. Integral controller/damper actuator is acceptable.
- D. Controllers used for remote temperature and humidity sensing, adjustment and override such as VAV air terminal unit controllers and fan coil units shall include S-link communication via two wire, unshielded cable (non polarity sensitive) to provide power and communication interface for remote sensors.

2.7 CONTROLLER ENCLOSURE AND LISTING

- A. Controllers shall be placed within enclosures that conform to NEMA-1 construction and shall further meet UL 94-5V flammability ratings for plenum application use.
- B. Each controller shall be listed as UL-916 and meet FCC Part 15 Class A.

2.8 GUI DISPLAY FRAMES

- A. System Access – The system must be set up to have at least 3 access levels: guest, user and administrator. Guest privileges shall be limited to view only. Users shall be able to make setpoint and schedule changes. Administrators shall have all privileges as users in addition to being able to assign passwords.
- B. System Level Equipment
 - 1. General – The air handling unit, heating hot water system and chilled water cooling system shall have a minimum of five (5) graphic screens available from the tree view.

2. Diagrammatic – One diagrammatic screen shall display the airflow pattern of the unit with all dampers, coils and fans shown in their correct schematic location and dynamic data for all input values shown. This main graphic screen shall show the control devices in mechanical flow diagram format with directional arrows to indicate normal flow arrangement. These screens shall be available to anyone with access to the system, and therefore shall be view only.
 3. Text Screen – Text screen shall display text information with the following primary categories:
 - a. Building or Zone Occupancy Status – Occupied/Unoccupied
 - b. Unit status – Enabled/Disabled
 - c. Temperatures – Zone Temperature & Temperature Setpoint
 - d. Heating or Cooling System Enable Status
 - e. Economizer Status
 - f. Static pressure & setpoints
 - g. Supply, return and exhaust fan status including setpoints.
 4. Loop Tuning Screen – A loop tuning screen shall also be furnished for each control loop, so that people with the appropriate access can change loop tuning parameters from PCs without needing individual programming tools.
 5. Override Screens – Override screens shall be furnished for each controller to permit overriding control points without the need for vendor specific software.
 6. Alarm Screen - An alarm screen shall also be furnished for each AHU, heating plant or cooling plant. The heating and cooling systems shall have similar screens as the AHUs.
- C. Zone Level Equipment – Each VAV air terminal unit shall have a graphics screen and a text screen.
- D. Systems that won't permit creating these customized screens as described herein will not be acceptable. Systems that use controllers that won't permit overrides of inputs and outputs from a browser based graphic screen will not be acceptable.
- E. Animations
1. All shapes shall be 3-D with a common perspective.
 2. All dampers shall have a minimum of 4 animation levels to show partially open, half open, mostly open, fully open, and closed position of dampers.
 3. All analog inputs shall show the actual value and engineering units on the graphic screen.
 4. Binary inputs shall be linked to flashing animated displays.
 5. Safety alarms will flash when in alarm.
 6. Filter status shall be indicated when value indicates that they are dirty.
 7. To prevent clutter on the graphic displays, symbols will only be shown for equipment that is controlled or monitored by the DDC system.
 8. Normal status for safeties will not be indicated, and normal status for safeties will be indicated by an image of a clean filter.
 9. Pumps and fans shall rotate when flow is proven by a monitoring device. Coils shall change color when valves are open to permit water flow through the coils.
- F. Color Schema – Graphics shall use common color schemes to make the overall system easy to understand. All overall backgrounds shall be white or other neutral color. All text shall be black. Any value that is in alarm shall be red or have a red background. Any value that is overridden shall have a blue background. All like sensors shall be the same color. For example,

all temperature devices shall be yellow, all pressure devices shall be purple, all humidity devices shall be teal, all fire alarm devices shall be red, and all CO2 devices shall be green.

- G. Current setpoints and occupancy status shall be shown at the bottom of each graphic screen.
- H. Floor Plans – Overall floor plan drawings shall be provided, and permit access to each zone's individual floor plan sections.
 - 1. On the individual floor plan sections, room numbers and room temperature and setpoint shall be displayed. Values that are out of the acceptable range shall appear in a different background color and/or flash.
 - 2. Each VAV air terminal unit shall have its own graphic screen that contains the points from within its controller including the box flow setpoint, room temperature setpoint, maximum cooling flow setpoint, minimum cooling flow setpoint, and minimum heating flow setpoint, plus the discharge air temperature from the AHU supplying the unit. The VAV text screen shall have the same information as the graphic screen plus high and low flow calibration values, damper rotation adjustment (CW or CCW), and air balance set-up features.
 - 3. GUI shall permit operator the ability to enable, set or disable high and low occupied and unoccupied limits for each room temperature reading.
- I. Text Screens shall be available for all levels of access. Setpoint and output values are changeable from the text screen for users with appropriate access privileges and administrators, but not guests. When a value can be overridden or edited, a red box shall appear around it when the cursor is position on it. A single click of the mouse shall bring up pop up menu that provide options to make a permanent override, change setpoint, or release a previous override of an output point. Analog inputs shall have pop up menus that allow setting high and low alarm limits and the ability to enable and disable alarm limits as appropriate for the sensing device. Pop up menus must be customized to include a description of the point that is being modified. Generic override menus are not permitted because they would not describe to an operator what is about to be modified. The Control Contractor shall set up all initial alarms as indicated in the point matrix.
- J. Text screens shall include schedule information including current state and date and time of next scheduled event. Positioning the mouse over the current state shall permit single click access to the schedule. The schedule screen shall allow the operator to edit a yearly, weekly, daily, holiday or special event schedule for the system being viewed. Temperature values and setpoints shall be displayed below the schedule information, and shall have a minimum of 1 decimal place. Heating, cooling and damper ouputs shall be displayed next. The OA temperature for economizer switchover shall be displayed and adjustable from the text screen. Air flow readings shall be shown with setpoint and actual readings. Fan information shall be shown next, followed by static pressure readings and setpoints, which shall have a minimum of 2 decimal places. Miscellaneous setpoints including night setback cooling and heating, average zone temperature, return air warm-up and cool-down, dehumidification, and unoccupied mixed air temperature setpoints shall all be shown and adjustable. All safeties shall be shown, followed by coil pump control information.
- K. Each system shall have its own specific alarm screen available to all operators but only editable by operators with user and administration access privileges. From the alarm screen, users and administrators shall be able to enable and disable alarms. Points that are in alarm shall have an

alarm symbol highlighted in red. Points that are not in alarm shall be shown in gray. Alarms that are disabled shall have a way to indicate this on the alarm screen graphic.

- L. Loop tuning screens shall be available through the web browser interface to save the owner the cost and time associated with using vendor specific software for tuning loops. Access to these screens shall not be provided to guests. Air handling units shall have dedicated screens for discharge air temperature, static pressure, and outside air control loops. Loop tuning screen for discharge air temperature shall include the discharge air temperature, discharge air temperature setpoint, cooling loop throttling range, I-gain and ramp time, heating loop throttling range, I-gain and ramp time, economizer loop throttling range, I-gain and ramp time, unoccupied heating loop throttling range, I-gain and ramp time, cooling valve output, heating valve output, and damper control output. Screens shall also have graphs that show 5 minutes of live data for the discharge air temperature, setpoint, cooling valve, heating valve and mixed air dampers. Each loop tuning screen shall include the appropriate throttling range, I-gain and ramp time.
- M. Each non-unitary controller shall have an override screen. These screens shall be available on-site for use during point-to-point check-out and commissioning. The override screen shall show the inputs and outputs for each controller with the points in their wired location. Unused points shall be shown as spares. Points that are in alarm shall have a red background, and points that are overridden shall have a blue background just as on other screens. These screens shall show the actual values that come back from the controller, not the values that may have been typed in for override at the GUI if the controller software is not accepting the override value. The override screen shall also permit timed overrides.
- N. Each air handling unit shall also have an overview screen listing every VAV terminals data in a text format that includes occupancy mode, room temperature, room setpoint, box flow, flow setpoint, temperature leaving VAV terminal, % cooling and % heating. Also, each VAV AHU shall have an air balance screen that will permit balancing the system through a computer connected to the Ethernet or directly to the appropriate BC without vendor specific software. The air balancing screens shall permit at least 8 manual override commands: normal, position (%), flow value, flow percent, open, close, min flow, and max flow.
- O. Heating systems and cooling systems with multiple pieces of equipment such as pumps with lead-lag control shall display which device is lead and when the other device will become lead on the text screen.
- P. Although only one outside air temperature sensor is needed per building, the GUI shall use independent outside air temperature points, so that during check-out and commissioning, the outside air temperature for a system can be changed without changing the outside air temperature for the whole building. The GUI shall also have a global outside air temperature point that can be overridden from the screen for the controller where the point is physically connected. Overriding this outside air temperature value will change it for all systems, except when outside air temperature has been overridden for an individual system.
- Q. The system shall allow for the easy development and editing of dynamic graphics. Wizards shall be utilized to assist the operator with their manipulation of the graphic system. The operator shall be able to, through a single mouse function, select between the dynamic display mode and the graphic edit mode for the currently viewed graphic frame, assuming appropriate access level is provided to the operator.
Systems requiring multiple mouse or operator

keyboard commands to enter the graphic edit mode are not desirable and require thorough definition of steps involved to accomplish function.

- R. Animation of system data shall be provided via graphic elements on the display frames. Standard graphic element library shall be provided to assist the operator with their implementation. The ability to define and add new animated graphic elements shall be provided. As a minimum, the ability to move, size, draw, arrange, align, layer, space, rotate, invert, duplicate, cut, copy, paste, erase any animated element shall be provided. System parameters and setpoints shall be assignable and modifiable by the animated graphic elements, relieving the need for keyboard commands for system manipulation.
- S. The ability to simultaneously display a dynamic X/Y chart of selected points, shall be provided. The chart shall be an element of the graphic display and shall automatically update with the display data. The chart shall allow for dynamic manipulation to modify the range, rate, and timeframe of view, in both a real-time as well as historical configuration. A minimum of 4 values shall be included on any chart display element. There shall not be a limit to the quantity of chart elements displayed on a graphic frame. Trace colors and X values shall be User configurable. Systems not providing this capability are required to provide an equivalent charting package with the GUI offering.
- T. The ability to provide graphically displayed global scheduling and editing functions shall be provided. The ability to link these functions to the associated equipment or zone frames shall be a standard feature. A calendar shall be provided for display and modification of the SDC time clock functions. The User shall be able to view a daily, weekly, monthly, annual, special or holiday schedule from a defined display frame. A list of served areas shall be displayed on the same screen, this list shall be displayed at all times, pull down menus or other means of accessing these areas shall not be acceptable. The system shall have a master override screen that will allow an operator to change the schedule for every piece of equipment in every building by changing the master schedule.
- U. All analog values shall be trended every 15 minutes. The trend samples shall be saved in the BC for at least 36 hours. Access to trended data shall be available by the single click of a mouse on the analog value. Systems that open other windows and require a selection of the desired data are not acceptable.

2.9 GUI ALARMING

- A. The GUI shall provide, as standard, alarm annunciation of system data. On every display frame, the ability to view, acknowledge, delete and manipulate real-time and historical alarms shall be provided. The ability to provide a unique and custom alarm display for every display frame shall be provided. The ability to continuously or upon request, view the alarm display, shall be provided.
- B. Alarm conditions shall be capable of invoking, as a minimum; a display frame, an email message, a text message sent to a pager or cellular phone.

- C. Alarm logging shall be provided in a user definable configuration. All alarms shall be displayed and/or routed as follows, as a minimum; GUI display frame, local printer, server printer, client printer, logged to file, and archived in standard format for information management. Alarm groupings shall be hierarchical in nature allowing up to 8 alarm groups and 16 sub-groups. The GUI shall not possess any limits on the quantity of alarms that can be logged, including historical data archiving. Systems possessing limits must define the restrictions and may not be acceptable.
- D. Provide up to 999 alarm priorities with up to 5 alarm color changes, per priority, according to alarm status.

2.10 GUI TRENDING

- A. The GUI shall automatically perform time based, user defined, periodic collection of real time point data. The data shall be presented as an X/Y chart in the display frame. The data shall be stored and archived in a file format that allows for the manipulation and utilization of the data by third party applications.
- B. A dynamic trend shall be defined as a group of at least 4 data points, with a circular buffer of 2000 data points. A historical trend shall be defined as a group of at least 8 data points, with the sampled points limited only by archival disk space. Sampling rates shall be user selectable from instantaneous (one per second) to once a week. Collection of data shall be user selectable to start and stop on a specific time and date. There shall be no limit to the number of X/Y charts within a display frame.
- C. X/Y charting and column and row reporting shall be an integral part of the system. All points shall be chartable or reportable. Analytical data shall be displayed for any of the selected points in a clearly displayed X/Y chart. This analytical data shall consist of at least the following: Average Mean, Standard Deviation, Simple Average, Current Value, Cycle Length, Cycle High and Cycle Low.
- D. X/Y charting shall provide for the following chart manipulation: display, zoom, scroll, centering, pen legend and export to Excel, Text via Dynamic Data Exchange.

PART 3 - EXECUTION

- 3.1 Furnish a complete set of shop drawings showing the kind of control equipment for each of the various systems and their functions, along with indication on the drawing of all original setpoints and calibration values and set up parameters, and sequence of operation and also that of the automation system. These drawings shall be submitted for approval to the Engineer, together with a complete brochure describing the equipment and their function and operation.
- 3.2 The control equipment supplier shall submit a detailed outline of the owner training material for review and comment by the Engineer during the shop drawing phase. The control system training program shall be customized to reflect the systems installed under this contract and

shall cover, as a minimum: software navigation (via custom graphics and Windows based icons), system architecture, pass wording and system security features, input/output control functions, alarm functions/acknowledgement, trending/long term reporting, and control component operation.

- 3.3 Upon completion of the project, furnish and turn over to the Owner and Architect (3) complete sets of brochures describing the various items of equipment, their functions and directions for operation and maintenance.
- 3.4 Upon completion of the control system, the Control Contractor shall adjust all components of the system. ATC Contractor shall make all adjustments in the control system required and as directed by the air balance contractor to achieve the desired air balance quantities. All instruments shall be carefully calibrated, and each control function shall be demonstrated to function properly, to the satisfaction of the Engineer and the Owner. Provide a complete instruction manual covering the function and operation of all components. At the time of demonstration, each function shall be simulated to ensure that controls respond properly to all signals, and the Owner shall be instructed in the proper operation of the system.
- 3.5 In addition to the adjustments and fine tuning, the Contractor shall include as a part of this contract an additional 40 hours of service technician time for work as directed or authorized by the Engineer to make software changes or field adjustments to hardware.
- 3.6 During the first year of operation, after acceptance by the Owner, the Control Contractor shall provide complete service to adjust or assist the Owner in adjusting the equipment to obtain optimum performance from the control equipment and from the heating and air conditioning systems in general. This shall be done without additional expense to the Owner. This work shall include revisions to DDC software programs and controller programs, and all PC front end software upgrades. All software shall be provided to the Owner in disk form, including back-ups of final field programs.
- 3.7 The control equipment manufacturer shall provide instruction and training of the Owner's personnel regarding the hardware and software of the system. Software training shall include programs, methods of programming, control loops, scheduling and reports. Training covering hardware shall include operation information, functional use, wiring diagrams and schematic diagrams necessary to troubleshoot the operating system. Training shall include "hands on" instructions to completely familiarize Owner's personnel with the equipment and system. Training of Owner's personnel shall be equal in scope and detail to that provided by the manufacturer to its service technicians.
- 3.8 TRAINING

The control equipment supplier shall provide 40 hours of instruction at the job site to familiarize the Owner's personnel in the application and details of the installed system. Site

training classes shall not be scheduled for longer than 4 hours duration except at the discretion of the Owner.

3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 - 2. Test and adjust controls and safeties.
 - 3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 - 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
 - 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 - 6. Test each system for compliance with sequence of operation.
 - 7. Test software and hardware interlocks.
- C. DDC Verification:
 - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
 - 2. Check instruments for proper location and accessibility.
 - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
 - 4. Check instrument tubing for proper fittings, slope, material, and support.
 - 5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
 - 6. Check temperature instruments and material and length of sensing elements.
 - 7. Check control valves. Verify that they are in correct direction.
 - 8. Check dampers. Verify that proper blade alignment, either parallel or opposed, has been provided.
 - 9. Check DDC system as follows:
 - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
 - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - c. Verify that spare I/O capacity has been provided.
 - d. Verify that DDC controllers are protected from power supply surges.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

END OF SECTION 23 0923

SECTION 23 0950 – VARIABLE-FREQUENCY MOTOR CONTROLLERS (VFD's)

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes solid-state, pulse-width modulated (PWM), variable frequency controllers (VFD's) for speed control of three-phase, squirrel-cage induction motors.
- B. VFD's shall be furnished where noted on the drawings or in the specifications. Provide a VFD for each motor except for supply or return fan wall applications where a single VFD is acceptable when so noted in the AH unit schedule.
- C. VFD's shall be furnished by the HVAC contractor to the Electrical Contractor who will mount the VFD and shall install power wiring required for the installation.

1.2 RELATED SECTIONS

- A. Section 23 0913 – Instruments and Control Devices
- B. Section 23 0914 – Control Wiring and Cabling
- C. Section 23 2123 – Hydronic Pumps

1.3 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of VFD.
- B. Shop Drawings: For each VFD.
 - 1. Include wiring diagrams.
 - 2. Indicate all accessories required for interface with building automation system for proper operation and control of the motor each drive serves.
- C. Field quality-control test reports.
- D. Operation and maintenance data.
- E. Indicate on the VFD submittals that they have been reviewed and coordinated with the direct digital control system to ensure that all necessary components and accessories are included for proper motor operation and control sequence.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.
- B. Comply with NFPA 70.
- C. Comply with IEEE Standard 519, Special Applications for Line Notching and Distortion. The manufacturer shall include any additional equipment to meet this requirement, including, AC line filter(s) of the RLC type and/or isolation transformer, or both to meet full compliance.

1.6 COORDINATION

- A. Coordinate features, accessories, inputs/outputs and functions of each VFD and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB (ACH 550 Series).
 - 2. Yaskawa (Z1000 Series).
 - 3. Square D ("S-Flex" Series).
- B. All variable frequency drives required for the HVAC systems shall be from a single manufacturer.

2.2 VARIABLE FREQUENCY CONTROLLERS

- A. Description: NEMA ICS 2, IGBT, PWM, VFD; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.
 - 1. Provide unit suitable for operation of premium-efficiency motor as defined by NEMA MG 1.
- B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- C. Output Rating: 3-phase; 6 to 60 Hz.
- D. Unit Operating Requirements:
 - 1. Input ac voltage tolerance of plus or minus 10 percent.

2. Input frequency tolerance of 60 Hz, plus or minus 6 percent.
 3. Minimum Efficiency: 96 percent at 60 Hz, full load.
 4. Minimum Displacement Primary-Side Power Factor: 96 percent.
 5. Overload Capability: 1.1 times the base load current for 60 seconds; 150 percent peak.
 6. Starting Torque: 100 percent of rated torque or as indicated.
 7. Speed Regulation: Plus or minus 1 percent.
- E. Isolated control interface to allow controller to follow control signal over an 11:1 speed range with input signal type as coordinated with temperature control contractor as applicable.
1. Electrical Signal: 4 to 20 mA at 24 V or 0-10 VDC.
- F. Internal Adjustability Capabilities:
1. Minimum Speed: 10 percent of maximum rpm.
 2. Maximum Speed: 100 percent of maximum rpm.
 3. Acceleration: 1 to a minimum of 600 seconds.
 4. Deceleration: 1 to a minimum of 600 seconds.
 5. Current Limit: 50 to a minimum of 110 percent of maximum rating.
- G. Self-Protection and Reliability Features:
1. Input transient protection by means of surge suppressors.
 2. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
 3. Motor Overload Relay: Adjustable and capable of NEMA ICS 2, 150 percent of rated current.
 4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
 5. Instantaneous line-to-line and line-to-ground overcurrent trips.
 6. Loss-of-phase protection.
 7. Reverse-phase protection.
 8. Short-circuit protection.
 9. Motor overtemperature fault.
 10. Power loss ride-thru (2 seconds).
- H. Automatic Reset/Restart: Attempts no less than three and no more than five restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
- I. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.
- J. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- K. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- L. Input Line Conditioning: As required to comply with IEEE 519.

- M. VFD Output Filtering: As required to comply with IEEE 519.
- N. Face-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control.
- O. Indicating Devices: Meter(s) or digital readout device(s) and selector switch, mounted on face of controller and connected to indicate the following controller parameters:
 - 1. Output frequency (Hz).
 - 2. Motor speed (rpm/Hz/percent, selectable).
 - 3. Motor status (running, stop, fault).
 - 4. Motor current (amperes).
 - 5. Motor torque (percent).
 - 6. Elapsed Time Meter (hrs)
 - 7. Fault or alarming status (code).
 - 8. PID feedback signal (percent).
 - 9. DC-link voltage (VDC).
 - 10. Set-point frequency (Hz).
 - 11. Motor output voltage (V).
 - 12. KW.
- P. Control Signal Interface:
 - 1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
 - 2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the DDC control systems:
 - a. 0 to 10-V dc
 - b. 4-20 mA.
 - c. Potentiometer using up/down digital inputs.
 - d. Fixed frequencies using digital inputs.
 - e. RS485.
 - f. Keypad display for local hand operation.
 - 3. Output Signal Interface:
 - a. A minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:
 - 1) Output frequency (Hz).
 - 2) Output current (load).
 - 3) DC-link voltage (VDC).
 - 4) Motor torque (percent).
 - 5) Motor speed (rpm).
 - 6) Set-point frequency (Hz).
 - 4. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of any available programmable setting.

5. Embedded communications protocol and interface communications card for LonWorks, BACnet or Ethernet/IP, as required by the temperature control contractor for the direct digital control system provided.
- Q. Communications: Provide an RS485 interface allowing VFD to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFD to be programmed via the direct digital control system. Provide capability for VFD to retain these settings within the nonvolatile memory.
- R. Drive enclosure shall incorporate an integral motor circuit protector circuit breaker or disconnect switch.
- S. Manual Bypass: Not required except where noted otherwise on the drawings
- T. Isolating Switch: Provide load break switch arranged to isolate VFD from supply source with lock-out provisions.
- U. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

2.3 MULTIPLE MOTOR CONTROL

- A. Where plans/schedules indicate a single VFD for control of multiple motors, the VFD shall be Manufacturer's Model/Series designed for multiple motor application and shall be sized appropriately for the sum of motors Full Load Amps (Horsepower) to be started/controlled simultaneously. The VFD shall include, within its enclosure:
 1. Separate, adjustable electronic overload or thermal overload protection for each individual motor to be controlled.
 2. Separate, integral motor circuit protector or disconnect switch for each individual motor to be controlled.
 3. Separate power terminals for each individual motor to be controlled.

2.4 ACCESSORIES

- A. Historical Logging Information and Displays:
 1. Real-time clock with current time and date.
 2. Running log of total power versus time.
 3. Total run time.
 4. Fault log, maintaining last four faults with time and date stamp for each.

2.5 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to VFD (NEMA 1 enclosure) before shipping.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Select features of each VFD to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, controller, and load.
- B. Select horsepower rating of controllers to suit motor controlled.
- C. Provide complete wiring diagrams for use in interfacing with the equipment. Include these diagrams with the shop drawings.

3.2 INSTALLATION

- A. VFD's will be furnished by the HVAC contractor and turned over to the Electrical contractor for mounting.

3.3 IDENTIFICATION

- A. Identify VFD's, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.4 CONTROL WIRING INSTALLATION

- A. Power wiring between the electrical distribution panel and the VFD as well as the wiring between the VFD and motor shall be installed by the Electrical Contractor.
- B. Control wiring shall be provided by the temperature control subcontractor.
- C. Bundle, train, and support wiring in enclosures.

3.5 FIELD QUALITY CONTROL

- A. Prepare for equipment start up as follows:
 - 1. Test insulation resistance for each supply and feeder circuit. Ensure that leads are not connected to VFD when meggar testing so as not to damage equipment components.
 - 2. Test continuity of each circuit.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following for equipment start-up:
 - 1. Inspect controllers, wiring, components, connections, and equipment installation. Ensure that all accessories, components, motor control parameters and programming capabilities are available and set for the required control sequence and are coordinated.

2. Coordinate the Manufacturer's Field Service Rep site visit to ensure all interested parties are present for equipment startup and verification of all control and setup parameters.

3.6 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate the operation of the variable frequency drive to the Owner's representative and provide complete instruction and training for the equipment. Demonstration shall include the use of bypass switch where provided, interface and control strategies and basic troubleshooting.

END OF SECTION 23 0950

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SECTION 23 0993 - SEQUENCE OF OPERATIONS FOR CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment.
- B. All equipment (valves, dampers, actuators, controllers, etc.) required to perform the functions specified shall be provided under this ATC contract unless noted herein or elsewhere in these contract documents.
- C. Electric motor driven equipment (pumps, chillers, compressors, cooling towers, etc.) shall be provided with minimum on (run) and minimum off timers to prevent short cycling of the equipment (coordinate with equipment manufacturer's).
- D. All DDC system control points shall have a default value in case of sensor failure or logic error.
- E. All controlled devices shall fail safe on loss of control.
- F. All set points and parameters shall be fully adjustable.

1.2 RELATED SECTIONS

- A. Section 23 0913 Instruments and Control Devices
- B. Section 23 0914 Control Wiring
- C. Section 23 0923 Direct Digital Control System

1.3 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

- A. Refer to Drawings for Sequence of Operations for equipment.

3.2 SEQUENCE PROGRAMMING

- A. Sequence logic shall be installed in a professional manner that demonstrates a full understanding of the sequence and maximizes energy conservation and smooth operation in strategies and techniques not covered by the sequence.
- B. All setpoints and control parameters shall be adjustable.
- C. All control loops shall utilize PID control algorithms unless application dictates otherwise.
 - 1. The proportional and integral values which make up the PID output value shall be readable and modifiable to facilitate tuning of control loops.
 - 2. All PID loops serving critical equipment shall provide for operator control of loop starting point without program editing when control is returned to program control after being in operator control.
 - 3. All loops shall have a virtual output in the loop statement to allow knowledge of loop performance before changing output from manual to program control.
- D. Global points – The outside air temperature sensor and other inputs that are used in multiple programs shall be attached to a single virtual point, which is used in the programs.
- E. Mode changes shall be stable. Abrupt changes that cause unnecessary opening of valves should not be used. Example: Do not abruptly change the supply air temperature setpoint when going from warmup mode to occupied mode.
- F. All logic statements or blocks shall be input with consistent naming conventions.
- G. The logic for separate DDC controllers serving AHUs with identical sequences of operation, shall also be identical.

3.3 INSTALLATION GENERAL

- A. All HVAC safeties shall be hardwired such that the shutdown will occur in Automatic and Hand and bypass modes at the BAS system and the starter.
- B. Software safeties are not acceptable (exception: smoke control may be done through software if the control system is UL listed for smoke control).

END OF SECTION 23 0993

SECTION 23 2113 – HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Pipe, Fittings and Joining Methods.
 - 2. Unions and flanges
 - 3. Dielectric Connectors
 - 4. Makeup-water piping.
 - 5. Pipe sleeves, openings, curbing and escutcheons
 - 6. Installation methods of piping
 - 7. Pipe Schedules
- B. Related Sections
 - 1. 23 0004 Fire Stopping for HVAC Systems.
 - 2. 23 0523 General Duty Valves.
 - 3. 23 0529 Pipe Hangers, Supports & Penetrations
 - 4. 23 2500 HVAC Water Treatment.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Pipe and fittings for each type utilized.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- B. Welders shall be qualified and fully certified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.
- C. Welding procedures and testing shall comply with ANSI Standard B31.1.0 Standard Code for Pressure Piping, Power piping and The American Welding Society Welding Handbook.

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- D. Piping between the power boiler (steam boiler above 15 psig) and the valve to valves required in ASME Code, Section 1 shall be in conformance with ANSI B31.1 – Power Piping. Welding shall be performed under PP certification and stamped.
- E. Safety valves and all pressure vessels shall bear the appropriate ASME label.
- F. All pressure piping systems regulated by the Ohio Pressure Piping Systems Code, Chapter 4101:8 shall conform to applicable requirements of the Code. Welders shall carry a current State of Ohio, Pressure Piping Board Certification. Each welder shall submit a copy of their signed performance qualification record to the Engineer for approval prior to beginning work on any pressure piping system.

PART 2 - PRODUCTS

2.1 STEEL PIPING PRODUCTS

- A. Refer to 'Piping Systems Schedule' on drawings.
- B. Reinforced forged welding outlets equal to Bonney Forge "Weldolet®" and "Thredolet®" shall be used where branch is two sizes smaller than the main. Unreinforced nipples and fish-mouthed connections are not acceptable.

2.2 COPPER TUBING (ASTM B88-86) PRODUCTS

- A. Refer to 'Piping Systems Schedule' on drawings.
- B. Mechanically formed tee fittings and couplings in copper tubing, such as T-Drill, are not permitted.

2.3 UNIONS AND FLANGES

- A. Unions on copper tubing, all bronze construction 150 lb., solder ends.
- B. Unions on steel pipe 2" and smaller, malleable iron with ground seat, bronze to steel, 300 lbs., screwed ends.
- C. Flanges on steel pipe with welded or screwed joints, 2-1/2" and larger. Flanges on copper tubing shall be class 150 cast copper alloy, soldered. Gaskets shall be 1/16" thickness full face compressed sheet suitable for temperature and pressure ranges of the application. Bolts for flanges hot water piping shall be No. 7 hardened bolts.

2.4 DIELECTRIC CONNECTORS

- A. A dielectric connector shall be incorporated at each connection between ferrous and copper piping. Connectors shall be:

1. Dielectric coupling with non-conductive polymer liner, Lochinvar Corp. "V-line" Dielectric fitting on services 180 degrees and less.
2. Dielectric flange with non-metallic bolt hole grommets and gasket.
3. Brass adaptor, for HVAC applications only.

PART 3 - EXECUTION

3.1 PIPING

- A. Pipe and tubing shall be cut and fabricated to field measurements and run parallel to normal building lines. Pipe ends shall be cut square and ends reamed to remove burrs. The pipe interior shall be cleaned of foreign matter before erection of the pipe.
- B. Annular space around piping through all walls shall be sealed off. Non-fire rated walls shall be sealed with pliable caulking or approved patching sealant. Fire rated wall penetrations shall be sealed per 23 0004 Fire Stopping for HVAC Systems.
- C. Piping shall be pitched for drainage. The low points shall be fitted with a ¾" drain valve (with hose thread adapter if not piped to a floor drain) except that on piping 1-1/4" and smaller where a drain valve is not shown, a drain plug is acceptable. Hose thread adapters on drain valves of potable water piping shall be fitted with a non-removable vacuum breaker.
- D. Piping shall be installed consistent with good piping practice and run concealed wherever possible. Coordinate with other trades to attain a workmanlike installation.
- E. Piping shall be supported as specified in Section 230529 Pipe Hangers. Pipe alignment in both the horizontal and vertical must be tightly maintained. Misalignment must be corrected to the satisfaction of the Engineer before insulation is applied and the system accepted.
- F. Internals of sweat end valves shall be removed when damage or warping may occur due to applied heat of soldering. Where silver brazing is specified, solder connection of valves shall be used to reduce the danger of damage.
- G. Piping within 2 ft. of the coil connections to small heating and/or cooling units, reheat box coils and duct coils may be Type "L" soft copper to facilitate connection in a confined space. Joints shall be brazed or soldered consistent with the piping system or flared-tubing fittings may be used where appropriate
- H. Close open ends of piping during installation to keep interior of the pipe clean.
- I. Piping shall not be run above electrical switchgear or panelboards, nor above the access space in the immediate vicinity of the equipment, in accordance with N.E.C. Article 384.
- J. Bulb wells for temperature sensing specified in the Controls and Instrumentation Section shall be furnished by the Control sub-contractor and installed by the Piping Contractor. Other types of control devices (differential pressure switches, flow meters, etc.) shall also be installed by the Piping Contractor. Devices, fittings (tees, weldolets, threadolets), locations and installation

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details shall be closely coordinated with the Controls sub-contractor and device manufacturer's instructions.

- K. Automatic control valves shall be furnished by the Controls sub-contractor for installation by the HVAC piping contractor. Flare fittings for flare end valves shall be provided by the HVAC piping contractor.
- L. Drawings (plans, schematics and diagrams) indicate the general location and arrangement of piping systems. Locations and arrangements of piping take into consideration pipe sizing and friction loss, pipe expansion, pump sizing and other design considerations; therefore, it is imperative that piping be installed as indicated.
- M. Air vents shall be installed at high points of piping and system, on each heating coil and cooling coil and at other locations subject to air binding. Air vents shall be installed in locations accessible for servicing. A shutoff valve or cock on the inlet and drain tubing extending to a drain is required for each large capacity automatic vent. The drain tube shall be extended to a drain location (floor drain, janitor sink, etc.) or, in mechanical rooms, turned down over a clear area of the floor to afford notice by maintenance personnel.
- N. Install strainers as indicated on the drawings. Provide a nipple and ball valve in the blow down connection of each strainer 2" and larger.
- O. Piping shall be cleaned per specification 23 2500 HVAC Water Treatment.
- P. Exposed pipe insulation shall be painted to match base material colors.

3.2 UNIONS AND FLANGES

- A. Unions and flanges shall be installed at pipe connections to fixtures and equipment and as required for erection purposed. A union shall be installed at each threaded shut-off valve on the side of the valve for which shutoff service is intended.

3.3 TESTING

- A. Piping shall be air tested at 50% higher than maximum system operating pressure for eight (8) hours before flushing.

END OF SECTION 23 2113

SECTION 23 2114 - HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes.

1. Hydronic Specialties and Accessories
 - a. Air Removal Fittings
 - b. Pressure Reducing Valves
 - c. Pressure Relief Valves
 - d. Make-up Water Assemblies
 - e. Reduced Pressure Backflow Preventer Assemblies
 - f. Self-Contained Thermostatic Control Valves
 - g. Air Vents
 - h. Strainers
 - i. Combination Valves (Triple-Duty)
 - j. Pump Suction Diffusers
2. Expansion Tanks
3. Chilled Water Buffer Tanks

B. Related Sections:

1. 23 0523 General Duty Valves
2. 23 0529 Pipe Hangers and Supports
3. 23 2113 Hydronic Piping.
4. 23 2500 HVAC Water Treatment

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 PERFORMANCE REQUIREMENTS

- A. Piping systems shall conform to ANSI and State rules for pressure piping where applicable. Welders and fitters shall be fully certified for work performed.
- B. Safety valves and all pressure vessels shall bear the appropriate ASME label.

1.4 SUBMITTALS

- A. Product Data: For each type of the following:
1. Hydronic specialties.

- B. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 HYDRONIC SPECIALTIES

- A. Air Removal Fittings – Combination Air & Dirt separator mounted in main pipe shall be equal to Bell & Gossett Coalescing ‘CRSN’. Inlet/Outlet connection style; NPT Male on piping less than or equal to 2.5”, Flanged for piping greater than 2.5”. Furnish a large capacity float type automatic air vent equal to Hoffman No. 792 with a ball shutoff valve for installation on the vent connection. Provide ¾” shut-off valve with threaded hose connection on drain port.
- B. Pressure Reducing Valves – For system water make-up shall be equal to Bell & Gossett Model B7-12 (adjustable setting 10 to 25 psi) / Model 7 (adjustable setting 25 to 60 psi), setting as indicated on the drawings.
- C. Safety Pressure Relief Valves
1. Description – Other than those on boilers, shall be ASME rated for water relief. For use of system over-pressurization.
 2. Construction – Low inlet pressure check valve, setting as indicated on the drawings. ¾” to 1” brass body, 1-1/2” to 2” cast iron body.
 3. Manufacturer
 - a. Bell & Gossett
 - 1) No. 790 (¾”)
 - 2) No. 1170 (1”)
 - 3) No. 3301 (1-1/2”)
 - 4) No. 4100 (2”)
 - b. Apollo Valve
 - c. Kunkle
 - d. Or approved equal.
- D. Reduced pressure backflow preventer assembly in the cold-water make-up line to the system shall be equal to Watts No. LF909 complete with valves, strainer, vents, test cock and an air gap funnel drain below the unit, piped to a floor drain.
- E. Air vents shall be manual type unless specifically noted to be automatic. Air vents shall be:
1. Large capacity automatic type for installation on boiler or air removal fitting, equal to Hoffman 792, 150 psig operating pressure rating. Provide a ball valve on the inlet pipe and pipe the outlet to the nearest drain.
 2. Large capacity automatic type, 150 psig operating pressure rating, equal to Hoffman 78. For use on air handling unit coils and on main piping. Provide ball valve at inlet of each vent. Pipe outlet to nearest drain point with 1/8” ID copper tube.
 3. Large capacity manual type – ½” ball valve for use on air handling unit coils and on main piping. Elbow down to facilitate catching water during venting.

4. Small capacity manual-automatic with screwdriver stop, 50 psi, equal to Hoffman 508, for use on room heating and cooling units, VAV unit heating coils and duct heating coils.
 5. Small capacity manual type air vent – 1/4” ball valve, for use on room heating and cooling units, VAV unit heating coils and duct heating coils. Elbow down to facilitate catching of water during manual venting.
- F. “Y” pattern inline strainers shall be 125 lb. w.s.p. minimum construction with removable stainless steel strainer element and screwed or flanged ends.
1. Strainers for use with copper pipe, size ½”-4”, shall be equal to Watts #LF777. Strainer elements shall be 20 mesh for 2.5” and smaller, 3/64” for 3”, and 1/8” for 4”.
 2. Strainers for use with steel pipe, sizes 2.5” and larger, shall be equal to Watts #77F-DI-125 or Watts #77F-DI-250.
- G. Combination Valves (Triple-Duty)
1. Description – Valves and devices such as a Triple-Duty Valve (check, balancing and shutoff) for installation on pump discharge are acceptable in lieu of individual components comprised of individual valves.
 2. Brass Triple Duty Valve
 - a. Construction – Brass straight pattern body, 200 psi w.s.p., calibrated ball valve, spring loaded check valve, calibrated nameplate with memory stop, rubber memory button, complete shutoff under pressure, chrome plated brass ball valve, EPDM rubber seals, stainless steel spring, extended handle and pressure/temperature ports, glass filled Noryl check valve body and threaded or flanged connections.
 - b. Manufacturers
 - 1) Bell & Gossett #3DV or approved equal by,
 - 2) Grundfos
 - 3) Armstrong
 - 4) Taco
 3. Cast or Ductile Iron Triple Duty Valve
 - a. Construction – Cast or ductile iron straight pattern body, 175 psi w.s.p., globe valve, spring loaded check valve, calibrated nameplate with multi-turn stem, rubber memory button, fully backseating brass valve disc, EPDM rubber seat, stainless steel spring and stem, and flanged connections.
 - b. Manufacturers
 - 1) Bell & Gossett #3DS or approved equal by,
 - 2) Grundfos
 - 3) Armstrong
 - 4) Taco
 - 5) Keckley
 - 6) Thrush
- H. Pump Suction Diffusers
1. Description – For pump inlet condition enhancement.
 2. Construction – Cast iron, angle-type body with flanged connection. Integrated flow cone, straightening vane, and diffuser-strainer-orifice cylinder. Include disposable fine mesh strainer to be removed after system start-up. Unit shall have pressure/temperature ports at the suction and discharge to allow for differential pressure measurement. 175 psi w.s.p., 1 psi max w.p.d. for rated flow.
 3. Manufacturers

- a. Bell & Gossett
- b. Grundfos
- c. Armstrong
- d. Taco
- e. Thrush

2.2 EXPANSION TANKS

- A. Manufacturers:
 - 1. Wessels – NLAP
 - 2. Armstrong – WX
 - 3. Bell & Gossett – Series B
 - 4. Grundfos – GFXA
 - 5. Niles - EBT
- B. Expansion tanks for pressurization and expansion control of the water systems shall be pressurized bladder type as indicated on the drawings, pre-charged to match the system make-up pressure.
- C. Each tank shall be welded steel constructed in accordance with ASME requirements for 125 psi. The tank shall be fitted with a system pipe connection drain tapping and an integral heavy-duty butyl rubber replaceable bladder, to separate water from the pressurized air. Bladder type tank shall have a bottom drain tapping with plug and a flanged top opening for removal and reinstallation of the bladder. Tank shall be prime coat or finish painted.
- D. The tank shall be vertical with floor mounting ring or horizontal with mounting cradles, as indicated on the drawings.
- E. Refer to project drawings for tank sizing information.

2.3 CHILLED WATER BUFFER TANKS

- A. Construction – ASME rated, vertical arrangement, 125 lbs. welded carbon steel construction, flanged connections, 3/4" underdrain, internal temperature stratification baffle, lifting rings, prime coat painted, and
- B. Mounting – Floor mounting ring.
- C. Refer to drawings for tank storage capacity.
- D. Manufacturers:
 - 1. Wessels – CBT or equal by
 - 2. Laars
 - 3. Niles
 - 4. Patterson
 - 5. American Wheatley

2.4

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Drawings (plans, schematics and diagrams) indicate the general location and arrangement of piping systems. Locations and arrangements of piping take into consideration pipe sizing and friction loss, pipe expansion, pump sizing and other design considerations; therefore, it is imperative that piping be installed as indicated.
- B. Refer to Section 23 2113 Hydronic Piping for installation of piping and accessory devices and equipment.
- C. Air Vent Locations – Air vents shall be installed at high points of piping and system, on each heating coil and cooling coil and at other locations subject to air binding. Air vents shall be installed in locations accessible for servicing. A shutoff valve or cock on the inlet and drain tubing extending to a drain is required for each large capacity automatic vent. The drain tube shall be extended to a drain location (floor drain, janitor sink, etc.) or, in mechanical rooms, turned down over a clear area of the floor to afford notice by maintenance personnel.
- D. Strainers – Install strainers as indicated on the drawings. Provide a nipple and ball valve in the blow down connection of each strainer 2” and larger. Remove screens when noted upon system startup.
- E. Safety Relief Valves – Pipe discharge to local drain.
- F. Expansion Tank Mounting – Vertical expansion tanks shall be floor set on a 4” high concrete base. Check and adjust the pre-charged pressure so that it matches the system make-up pressure.
- G. Chilled Water Buffer Tank Mounting – Vertical buffer tanks shall be floor set on a 4” high concrete base.

END OF SECTION 23 2114

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SECTION 23 2117 – GLYCOL HEAT TRANSFER FLUID

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Ethylene Glycol
2. Glycol Feed Equipment

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 FREEZE PROTECTION FLUID

- A. Ethylene glycol freeze protection fluid with special inhibitor formulation for HVAC application.
- B. Manufacturers:
1. Dow Chemical “Dowtherm SR-1”.
 2. Interstate Chemical “Intercool NFE”
 3. Union Carbide “Ucartherm”

2.2 AUTOMATIC GLYCOL FEED EQUIPMENT

- A. Packaged automatic glycol feed unit consisting of a tank, pump piping devices, control panel, and sensors all mounted on a primed and painted steel frame.

1. Tank: 50-gallon polyethylene with 1/3 hinged PE cover supported by the assembly.
2. Control Panel: NEMA 4x panel with 8-foot power cord and plug, 2-position main power switch and light, 3-position (hand/off/auto) switch and light for pump, red low light and 15-amp fuse.
3. Pump: 1/3 HP gear pump providing 1.6 GPM at 100 psi. Pump suction PVC ball valve, flexible tubing and cast-iron strainer. Pump discharge PVC ball valve, PVC spring check valve and 0.25" NPT back tap pressure gauge.
4. Pressure Switch: 0.25" NPT pressure switch
5. Pressure Relief Valve: 0-150 psig, PVC relief valve and gauge.

B. Manufacturers:

1. J.L. Wingert Co – Model GL50-E1
2. Neptune Chemical Pump Co.
3. Advantage Controls.

PART 3 - EXECUTION

3.1 REQUIREMENTS

- A. The chilled water piping system shall be provided with 30% by volume, ethylene glycol.
- B. Provide extra 50 gallons of concentrated ethylene glycol. Place containers where directed by the owner.

3.2 INSTALLATION

- A. Prior to the introduction of the glycol solution, the piping system shall be thoroughly cleaned and prepared in accordance with Section 23 500 HVAC Water Treatment.
- B. Provide valved inlet connections, sampling valves, air vents, etc. Pump the solution into the piping, bleed air manually, circulate and test for correct concentration.
- C. When concentrated ethylene glycol is mixed on the job site, it shall be thoroughly mixed in a drum or drums to the specified solution prior to introduction in the piping system.
- D. Set glycol feed unit/tank and connect to the system on the suction side of the pumps/where indicated on the drawings.

END OF SECTION 23 2117

SECTION 23 2123 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Pipe mounted In-Line.
 - 2. Base mounted end suction
- B. Related Sections
 - 1. 23 0513 Electrical Requirements for HVAC Equipment
 - 2. 23 0530 Equipment Bases and Supports

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.
- B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: 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. UL Compliance: Comply with UL 778 for motor-operated water pumps.
- C. Pumps shall be tested and rated in accordance with Hydraulics Institute standards.

PART 2 - PRODUCTS

2.1 MOTORS

- A. Motors shall be 1750 rpm unless specifically noted otherwise. Motors shall be sized to not overload or enter into the service factor area at any point on the operating curve of the pump. Submittals shall include pump curves. Drives and couplings shall be protected with guards conforming with OSHA standards.
- B. Motors 1 HP and larger shall be “premium efficiency” series motors.

2.2 PIPE MOUNTED IN-LINE

- A. Air Handling Unit Coil Pump
 - 1. Centrifugal type, system lubricated (wet rotor) with cast iron pump casing and motor with internal overload protection.
 - 2. Manufacturers:
 - a. Bell & Gossett ecocirc-xl, or equal by
 - b. Armstrong
 - c. Grundfos
 - d. Patterson
- B. Boiler Primary Pumps
 - 1. Vertical motor axis pipe mounted close coupled centrifugal, bronze fitted with cast iron casing, brass or bronze impeller, mechanical seals, flanged ends and close coupled motor.
 - 2. Manufacturers:
 - a. Bell & Gossett Series e-80, or equal by
 - b. Armstrong
 - c. Grundfos
 - d. Patterson

2.3 BASE MOUNTED END SUCTION

- A. Base mounted end suction pumps shall be centrifugal type with flexible coupling, motor and channel steel or cast iron base with “back pull out” design. Each pump shall be bronze fitted with cast iron casing, bronze impeller, grease lubricated ball bearings, mechanical seals and flanged pipe connections (except pumps 2” and smaller may be threaded end).
 - 1. Manufacturers:
 - a. Bell & Gossett Series e-1510, or equal by
 - b. Armstrong
 - c. Grundfos
 - d. Patterson

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

- A. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- B. Independently support pumps and piping so the weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- C. Install continuous-thread hanger rods and spring hangers of sufficient size to support pump weight.
- D. Set base-mounted pumps on concrete foundation or a spring mounted concrete inertia base, as noted on the drawings. Disconnect coupling before setting. Do not reconnect couplings until the alignment procedure is complete.
- E. Furnish a spare pump seal for each type and size of pump.

3.2 ALIGNMENT

- A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.
- B. Comply with pump and coupling manufacturers' written instructions.
- C. After alignment is correct, tighten foundation bolts evenly, but not too firmly. Completely fill baseplate with non-shrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten the foundation bolts.

END OF SECTION 23 2123

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SECTION 23 2500 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following HVAC water-treatment systems:

1. Bypass (Shot) chemical-feed equipment and controls.
2. Biocide chemical-feed equipment and controls.
3. Chemical treatment test equipment.
4. Pipe cleaning procedures.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 PERFORMANCE REQUIREMENTS

- A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.
- B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- C. Closed hydronic systems, including hot-water heating and chilled water shall have the following water qualities:
1. pH: Maintain a value within 9.0 to 10.5.
 2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
 3. Boron: Maintain a value within 100 to 200 ppm.
 4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
 5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
 6. TDS: Maintain a maximum value of 10 ppm.
 7. Ammonia: Maintain a maximum value of 20 ppm.
 8. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
 9. Microbiological Limits:
 - a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
 - b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
 - c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
 - d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
 - e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: Power and control wiring.
- C. Field quality-control test reports.
- D. Other Informational Submittals:
 - 1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.
 - 2. Water Analysis: Illustrate water quality available at Project site.
 - 3. Passivation Confirmation Report: Verify passivation of galvanized steel surfaces and confirm this observation in a letter to Architect.

1.5 QUALITY ASSURANCE

- A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUAL CHEMICAL-FEED EQUIPMENT

- A. Bypass (Shot) Filter Feeders: Refer to Section 23 2114 Hydronic Specialties.
- B. Water Meter – Provide on heating hot water system makeup water assembly.
 - 1. AWWA C700, oscillating-piston, magnetic-drive, mechanical totalization meter.
 - 2. Body: Bronze.
 - 3. Maximum Pressure Loss at Design Flow: 3 psig.
 - 4. Registration: Gallons.
 - 5. Controls: Flow-control switch with normally open contacts; rated for maximum 10 A, 250-V ac; and that will close at adjustable increments of total flow.

2.2 CHEMICALS

- A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified in Part 1 "Performance Requirements" Article.
- B. System Cleaner:
 - 1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

- A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 INSTALLATION

- A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.
- B. Install water testing equipment on wall near water chemical application equipment.
- C. Install interconnecting control wiring for chemical treatment controls and sensors.
- D. Mount sensors and injectors in piping circuits.
- E. Bypass Filter Feeders: Install in closed hydronic systems, including hot-water heating and equipped with the following:
 - 1. Install bypass filter feeder in a bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
 - 2. Install water meter in makeup water supply.
 - 3. Install test-coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
 - 4. Install a gate or full-port ball isolation valves on inlet, outlet, and drain below feeder inlet.
 - 5. Install a swing check on inlet after the isolation valve.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

- C. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Division 23 Section "Common Work Results for HVAC."
- D. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Division 23 Section "General-Duty Valves."
- E. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers required in makeup water connections to potable-water systems.
- F. Confirm applicable electrical requirements in Division 26 Sections for connecting electrical equipment.
- G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 PIPE CLEANING

- A. Pipe cleaning shall occur before the system is filled with water for leak testing or water balancing.
- B. The cleaning and passivating solution shall be formulated to remove light grease, cutting oils, loose mill scale, organics and extraneous construction debris. The cleaner shall include a polyphosphate, an ionic dispersant and a low foaming surfactant.
- C. Sufficient cleaner shall be used to treat all piping to remove oil and grease to permit a uniform passivating film.
- D. Place terminal equipment control valves in the open position during cleaning. Provide temporary piping connections at the ends of all dead end branches to provide a connection between the supply and return piping to circulate the cleaning solution. The temporary connection must be removed, not simply valved off, after pipe cleaning is complete.
- E. Systems shall be filled, started, vented and flushed with clean water prior to cleaning. Use water meter to record capacity in each system.
- F. Refill system and add required quantity of cleaning chemical solution into the circulating system. Solution shall be introduced before the circulation pumps so that pump operation will ensure rapid mixing and distribution of the solution throughout the system. A small amount of antifoam agent may be added to prevent excess foaming.
- G. Where the piping system is used for heating purposes, warm the water to between 80 and 90 deg.F. during the cleaning process.
- H. Circulate the solution throughout the system for 24-36 hours.

- I. Open and drain dirt legs and low points periodically during the cleaning process. Drain the system completely paying particular attention to dirt legs and low areas of the system where settling can occur.
- J. Refill system with clean potable or industrial water and clean all strainer screens. Circulate for 8-12 hours and completely drain system as before.
- K. Refill the system. The length of time between the completion of the cleaning procedure and the addition of the corrosion inhibitor shall not exceed 24 hours.
- L. Add the recommended inhibitor based on the measured system volume.
- M. Cleaning service technician shall provide a report certifying cleaning has occurred in accordance with the above procedure and the report shall be included in the Owner's manual.

3.5 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. Report results in writing.
- B. 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.
- C. Tests and Inspections:
 - 1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
 - 2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
 - 3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
 - 4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
 - 5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
 - 7. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
 - 8. Repair leaks and defects with new materials and retest piping until no leaks exist.
- D. Remove and replace malfunctioning units and retest as specified above.

- E. At eight-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article.
- F. Comply with ASTM D 3370 and with the following standards:
 - 1. Silica: ASTM D 859.
 - 2. Acidity and Alkalinity: ASTM D 1067.
 - 3. Iron: ASTM D 1068.
 - 4. Water Hardness: ASTM D 1126.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.

END OF SECTION 23 2500

SECTION 23 3113 - DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Duct materials.
2. Duct liner.
3. Rectangular ductwork.
4. Round ductwork.
5. Flat Oval ductwork.
6. Duct connectors.
7. Sealants and gaskets.
8. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
1. Fabrication, assembly, and installation techniques.

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2. Factory- and shop-fabricated ducts and fittings.
 3. Reinforcement and spacing.
 4. Seam and joint construction.
 5. Duct Connectors
 6. Duct Liner
 7. Duct Sealants and Gaskets
 8. Penetrations through fire-rated and other partitions.
 9. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 10. Hangers and supports, including methods for duct and building attachment and vibration isolation.
- C. Coordination Drawings: Plans, drawn to scale (1/4" = 1'-0"), on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Duct installation, indicating coordination with general construction, building components, and other building services. Indicate any proposed changes to the duct layout.
 2. Suspended ceiling components.
 3. Structural members to which duct will be attached.
 4. Size and location of initial access modules for acoustic tile.
 5. Penetrations of smoke barriers and fire-rated construction.
 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.
- D. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to 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 D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 DUCT MATERIALS

- A. Refer to 'Ductwork Systems Schedule' on drawings.

2.2 RECTANGULAR DUCTWORK

- A. Construction
 - 1. Single wall factory- or shop-formed continuous helical (spiral) lock seam.
- B. Fittings/Transitions – Shall conform to SMACNA Figure 2-7.
 - 1. Transition angles shall be limited to 30 degrees on converging transitions and 20 degrees on diverging transitions.
 - 2. Elbows shall have an inside radius equal to the duct width. 90-degree elbows shall be square with double wall turning vanes. Elbows less than 90 degrees shall be radiused. Non-radiused elbows less than 90 degrees, with or without turning vanes are not permitted.
 - 3. Branch take-offs, where not detailed otherwise, shall be with a static boot (45-degree clinch collar) per SMACNA Figure 2-6 or conical spin-in fitting. Straight tap take-offs are not permitted.
 - 4. Square throat, radius heel 90-degree elbows are not permitted.
 - 5. Radiused, angled (15° Max.), or mitered (15° Max.) offsets.
 - 6. Concentric Transitions, $\theta = 45^\circ$ Max.
 - 7. Eccentric Transitions, $\theta = 30^\circ$ Max.

2.3 SINGLE WALL ROUND AND FLAT OVAL DUCTWORK

- A. Medium pressure applications (2" S.P. and higher).
 - 1. Construction
 - a. Single wall factory- or shop-formed continuous helical (spiral) lockseam.
 - 2. Joints/Seams
 - a. Slip connections or gasketed flanges.
 - 3. Fittings/Transitions – Shall be compatible with duct system.
 - a. 90-Degree Branch tees shall be streamlined, spin-in conical type with Y branches.
 - b. 45-Degree lateral tee wherever possible.
 - c. Die-stamped elbows, $r/D = 1.5$ (minimum).
 - d. Radiused, angled (15° max.) or mitered (15° max.) offsets.
 - e. Concentric transitions, $\theta = 45^\circ$ max.
 - f. Eccentric transitions, $\theta = 30^\circ$ max.
- B. Low pressure applications (1" S.P. or less).
 - 1. Construction
 - a. Single wall factory- or shop-formed continuous helical (spiral) lockseam.

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2. Joints/Seams
 - a. Slip connections or gasketed flanges.
 - b. Round Ductwork: Longitudinal seams may be utilized for 1" and less (positive and negative) static pressure construction class at final air devices.
3. Fittings/Transitions – Shall be compatible with duct system.
 - a. Factory- or shop-formed and welded.
 - b. Elbows shall be long radius type.
 - c. Elbows for longitudinal seam round ductwork shall be factory- or shop-formed segmented standing seam or pleated. Other fittings shall be comparable to the elbows.
 - d. Round Ductwork Additional Provisions:
 - 1) Standard tees allowed.
 - 2) Segmented elbows allowed.

2.4 DUCT CONNECTORS

A. Rectangular Duct Connectors

1. Connections shall be equal to Ductmate Industries "25 and "35" may be used on rectangular ductwork except where welding or brazing is specifically required. Adhere strictly to manufacturer's instructions.

B. Round duct branch connection to rectangular sheet metal duct

1. Connections shall be equal to Flexmaster Series FL, straight side with or without manual damper, as described on the drawings. Connectors installed on interior lined rectangular duct shall have an integral insulation guard sleeve.

C. Rectangular tap-to-round branch connection with static boot configuration

1. Connections shall be equal to Flexmaster USA Type STO. Buckley "Air-Tite" Bellmouth BM and BM-D fittings with neoprene gasket and adhesive facing may be used for duct taps to rectangular sheet metal duct which is not internally lined.

2.5 SEALANT AND GASKETS

A. Duct sealant materials shall be:

1. Water based synthetic latex emulsion duct sealant equal to Ducmate PROSeal.
 - a. No V.O.C.'s
 - b. UL 181B-M Listed, UL 723 classified
 - c. For applications up to 15" w.g.
 - d. Gray Color

B. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.6 HANGERS AND SUPPORTS

- A. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- B. Hanger Rods
 - 1. Noncorrosive Environments: Cadmium-plated steel rods and nuts.
 - 2. Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Steel Cables
 - 1. Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
 - 2. Stainless-Steel Ducts: Stainless steel complying with ASTM A492.
- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. 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

- A. General
 - 1. 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.
 - 2. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- B. Ductwork Coordination
 - 1. General Coordination – Coordinate duct layout carefully with other trades to avoid conflict with structural elements, lighting and plumbing- heating piping. Flattening of ductwork and offsets to fit ductwork in available space is generally shown. In the absence of such, the Contractor shall arrange the ductwork to maintain concealment and allow ceilings and lights to be installed as intended. Do not hang ductwork until possible interferences with electrical and mechanical trades have been resolved. Having ductwork

fabricated and delivered in advance shall not be justification for interference with other trades.

2. Coordination Drawings – The HVAC Contractor shall provide a complete set of ¼" = 1'-0" sheet metal fabrication drawings. The drawings shall be noted with duct size and installation elevations from the finished floor. The drawings shall be used for overall coordination with the other trades. Meet with the other trades prior to developing and finalizing these drawings.

C. Joints & Seals

1. Transverse joints and longitudinal seams shall be assembled with sealant to conform to SMACNA Class B seal. Selection of sealant materials shall be compatible with the application. Sealants shall be applied in accordance with the manufacturer's recommendations.
2. System Pressure Testing – Ductwork systems operating at 3" S.P. or greater (positive or negative) and all exterior ductwork shall require duct pressure testing.

D. Hangers, Straps & Supports – Attachment of hangers, straps, and supports to the structure shall be as follows:

1. Concrete Construction
 - a. Pre-set concrete inserts – In concrete construction of 4" minimum depth.
 - b. After-set concrete inserts – In 4" minimum depth concrete, set in drilled holes. Powder actuated driven fasteners are not permitted.
2. Steel Construction – Utilize beam clamps in steel beam construction. For steel joists, provide clamps or threaded rod, nuts and washers through the bottom chord. Provide anchoring where clamps are attached to sloping surfaces of beam flanges and where otherwise required to insure permanent attachment.
3. Unistrut Channel – Unistrut type channel support systems may be utilized. Channels should be attached to the structure with inserts or clamps. Utilize threaded rod and appropriate attachments with channels as required.
4. Deck Mounting – *Attachment to steel deck is prohibited.* Span from steel structural members with supplementary steel shapes where direct attachment to structural members is not practical. This does not apply to steel decks with concrete slab poured on the deck. Refer to Parts A. and B. above.
5. Refer to Drawings for additional notes on supports and hangers.

E. Duct Routing and Penetrations

1. General Coordination – Coordinate openings required for the passage of ductwork through walls, partitions, floors and roofs with the General Contractor.
2. Electrical Coordination – Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures. Ductwork shall not be run above electrical switchgear or panelboards, nor above the access space in the immediate vicinity of the equipment in accordance with NEC.

3. Wall Penetrations
 - a. Non-Fire-Rated Penetrations – 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.
 - b. Fire-Rated Penetrations – Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers where required or fire seal perimeter of duct when no damper is required. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
 4. Sleeves & Concrete Curbs
 - a. Sleeves – Sheet metal sleeves in conjunction with fire dampers shall be placed in walls and floors to pass ductwork. Floor sleeves shall project 4" above the finished floor in equipment rooms and areas of similar usage, and shall form a waterproof seal.
 - b. Concrete Curbs – Exceptions to sleeves shall be at locations where the opening is protected from drainage falling thru by means of concrete curbs or shaft walls. This Contractor shall be responsible for providing 4" high x 4" wide concrete curbs with beveled edges to protect floor openings related to his work in equipment rooms or providing an equal effective waterproofing metal curb, if not specifically included in the General Contract.
- F. Duct Protection & Cleaning
1. Protect duct interiors from moisture, construction debris and dust, and other foreign materials by covering each open end of the duct with visqueen secured with duct tape before the end of each day's work. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."- Duct Cleanliness Level – Intermediate
- G. Drainage – Wet exhaust ductwork shall be pitched back to the dishwasher hood / back to the grilles to drain. Provide trapped 1" drain piping from low points and extend to a floor drain or other drain point, if required. Longitudinal seams shall not be located along the bottom of a horizontal duct.
- H. Duct Liner – Interior insulating duct liner shall be installed in strict accordance with manufacturer's printed instructions and SMACNA standards.
1. Liner in rectangular duct shall be shop-applied with adhesive over 90% of the surfaces and with weld pins.
 2. Edges not factory-sealed, cut edges and all joints shall be coated and closed with an adhesive-sealant, both in shop fabrication and field assembly. Leading edges shall be protected with metal "Z" or channel nosing where air velocity exceeds 3,000 fpm.
 3. Duct liner shall be protected from getting wet or dirty while being transported to the building site, stored on site and after installation.
- I. Painting
1. Where interior duct surfaces are visible through grilles, registers and diffusers, the inside of the duct shall be coated with flat black paint before the device is installed, to eliminate obtrusive appearances.

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2. All exposed ductwork not installed with insulation in finished spaces to be painted shall be prepared for painting by the General Contractor to match Architect's base material colors.

END OF SECTION 23 3113

SECTION 23 3119 - PLENUM CASINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes shop and field fabricated plenum casings for outside, vent and exhaust air systems, including access doors.

1.2 RELATED SECTIONS

- A. Section 23 0713 – Duct Insulation
- B. Section 23 3113 – Ductwork
- C. Section 23 3300 – Air Duct Accessories

1.3 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.4 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.5 PERFORMANCE REQUIREMENTS

- A. Structural Performance:
 - 1. Casings shall be fabricated to withstand 2.5” positive or negative static pressure without structural failure. Wall and roof deflection at the indicated static pressure shall not exceed 1/8 inch per foot of width.
 - 2. Elevated casings 3’ high and larger that are provided with access doors shall have the bottom floor designed to support the weight of a maintenance worker.

1.6 SUBMITTALS

- A. Shop Drawings: Provide construction details including reinforcement, sealing, liner, devices, etc.

1.7 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 GENERAL CASING FABRICATION REQUIREMENTS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 6, "Equipment and Casings," for acceptable materials, material thicknesses, and casing construction methods unless otherwise indicated.
- B. Plenum casings shall be single wall, external standing seam, galvanized metal construction designed for 2" positive and 2" negative construction except the floor. The floor of the plenum casing shall be stainless steel construction with continuously welded seams and joints. The stainless-steel floor shall be a pan construction, with continuously welded edges turned up a minimum of 12" on all sides that extend up and connect to the galvanized wall. Alternatively, the entire plenum casing can be galvanized construction with a stainless-steel pan as described extending across the entire floor of the plenum.
- C. Metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- D. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M, G90 finish.
- E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized. Black steel may be used on the exterior of the plenum only; all interior metal shall be stainless steel or galvanized sheet metal as described. All fasteners, joints, threads, etc. where the galvanizing has been removed shall be cold galvanized in the field.
- F. Sealing Requirement: SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class A. Seal all seams, joints, connections and abutments.
- G. Penetrations: Seal all penetrations air and water tight. Cover with escutcheons and gaskets, or fill with suitable compound.
- H. Plenums shall be externally insulated in the field.

2.2 SEALANT MATERIALS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. 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. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Service: Indoor.
9. Substrate: Compatible with galvanized sheet steel and stainless steel.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single component, acid curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. Use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Field-cut openings for pipe and conduit penetrations; insulate and seal according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Support plenum casings from the floor or from structural wall and roof elements. Support components rigidly with ties, braces, brackets, and anchors of types that will maintain housing shape and prevent buckling.
- C. Align casings accurately at connections, with smooth interior surfaces.
- D. Provide plenum access door per Section 23 3300 Air Duct Accessories Section. Full sized doors shall be provided unless limited by plenum size.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Perform field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual."

3.3 CLEANING

- A. Comply with Division 23 Section "Metal Ducts."

END OF SECTION 23 3119

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Air Control Dampers & Accessories
 - a. Manual balancing dampers.
 - b. Backdraft dampers.
2. Life Safety Dampers & Accessories
 - a. Fire dampers.
 - b. Smoke dampers.
3. Pressure Differential gauges.
4. Turning vanes.
5. Duct-mounted access doors.
6. Flexible connectors.
7. Flexible ducts.
8. Air blenders.
9. Sound attenuators:
 - a. Return Air Canopy

B. Related Sections:

1. Section 23 0553 – Identification for HVAC Systems – For valve tags and schedules.
2. Section 23 3113 – Ductwork – For ductwork materials, requirements, and schedules.
3. Section 23 0593 – Testing, Adjusting and Balancing – For testing, adjusting, and balancing requirements for metal ducts.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

- 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. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
 - d. Wiring Diagrams: For power, signal, and control wiring.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- 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 AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 AIR CONTROL DAMPERS & ACCESSORIES

A. MANUAL BALANCING DAMPERS & ACCESSORIES

1. Steel Rectangular Dampers

- a. Construction
 - 1) General – Single cross-blade up to 12 blade widths and in larger sizes, multiple blade type 6" maximum width with opposed blade arrangement.
 - 2) Frame – 16 ga., galvanized steel hat channel with reinforced corners
 - 3) Blades – 14 ga., galvanized steel, one piece airfoil shape, opposed/parallel (as notes) blade. Synthetic blade edge seals.
 - 4) Jamb Seals – 300 Series stainless steel cambered compression type.
 - 5) Linkage – Out of airstream steel assembly
 - 6) Leakage Class – Class 1A
- b. Manufacturers
 - 1) Ruskin CD60 or approved equal by
 - 2) Greenheck
 - 3) Nailor
 - 4) Pottorff
- c. Manufacturers
 - 1) Ruskin CD50 or approved equal by
 - 2) Greenheck
 - 3) Nailor
 - 4) Pottorff

2. Steel Round Dampers

- a. Construction
 - 1) General – Single blade design.

- 2) Frame – 20-ga. galvanized steel.
- 3) Blades – 20-ga. galvanized steel.
- 4) Control Shaft – Square axle shaft.
- 5) Max Velocity – 1500 fpm.

b. Manufacturers

- 1) Ruskin #MDRS25 or approved equal by
- 2) Greenheck
- 3) Nailor
- 4) Pottorff

3. Damper Adjustment Handle

a. Construction

- 1) General – Locking quadrant positioner with handle
- 2) Handle – Heavy gage steel handle to accept square rod.

b. Schedule

- 1) Uninsulated ductwork – Ventfabrics "Ventlock" #641
- 2) Externally insulated ductwork – Ventfabrics #644

c. Manufacturers

- a) Ventfabrics
- b) Duro Dyne
- c) DynAir

B. BACKDRAFT DAMPERS

1. Construction

- a. General – Adjustable, counterbalanced type.
- b. Frame – Extruded aluminum, 12-ga., galvanized steel brace at corners.
- c. Blades – Extruded aluminum with extruded vinyl blade edge seals mechanically locked into blade edge.
- d. Bearings – Corrosion resistant, synthetic type.
- e. Counterbalance – Zinc plated bar on blades.

2. Manufacturers

- a. Ruskin #CBD6 or approved equal by:
- b. Greenheck
- c. Nailor
- d. Pottorff

2.2 LIFE SAFETY DAMPERS & ACCESSORIES

A. FIRE DAMPERS

- 1. Compliance – Dampers shall be constructed and tested to conform with UL 555 and shall be UL listed. AMCA Leakage Classes.

2. Construction
 - a. General – Dynamic rated, folded blade curtain type with blades folded in the head of the damper housing. Equipped with a 165°F fusible link (unless otherwise noted).
 - b. Horizontal Air Streams – Gravity-drop type.
 - c. Vertical Air Streams – Spring-loaded type.
3. Damper Schedule – The following is a description of the fire damper types as indicated on the plans:
 - a. TYPE “A”
 - 1) Low velocity (below 2000 fpm) with blades stored in the air stream.
 - b. TYPE “B”
 - 1) Low velocity with blades stored out of the air stream.
 - c. TYPE “C”
 - 1) High velocity with blades stored out of the air stream and rectangular, round, or oval duct collar each side.
 - d. TYPE “D”
 - 1) Horizontal ceiling radiation classified damper, folded type equal to Ruskin CFD and CFDR, with coated fire-retardant fabric over blades, and spring-closing mechanism. Dampers are to be mounted in conjunction with diffusers, grilles, and registers in fire rated ceiling assemblies to maintain fire integrity of the UL listing of the floor-ceiling or roof-ceiling assembly. Installation shall conform to manufacturer’s instructions for mounting, connection and support or dampers and insulating board protection over diffusers and duct above.
4. Controls – Fire dampers located at double wall locations shall be provided with a closed position proving micro-switch. Switch shall change state if the fusible link releases and closes the fire damper. The switch shall be equal to Honeywell BX-2RW863-A2.
5. Manufacturers
 - a. Ruskin
 - b. Greenheck
 - c. Pottorff
 - d. Nailor
 - e. Duro Dyne

B. SMOKE DAMPERS

1. Compliance – Dampers shall be constructed and tested to conform to UL 555S and shall be UL labeled. AMCA Leakage Classes.
2. Construction – Dampers shall have center pivoted multiple blades complete with blade and jamb seals and factory furnished and installed two-position actuator and linkage.
3. Electrical & Controls –
 - a. Electric Type – The actuator shall be a 120-volt electric operator, arranged for powered opening and spring return closing of the damper. The current draw shall be not more than 0.25A running.
 - 1) Basis of Design – Honeywell #H2000 or approved equal.

4. Damper Schedule – Dampers in ducts with velocities:
 - a. Less than or equal to 2,000 fpm – Leakage Class II (10 cfm/sq. ft. at 1” S.P.)
 - b. Greater than 2,000 fpm – Airfoil blades and Leakage Class I (4 cfm/sq. ft. at 1” S.P.).
5. Manufacturers
 - a. Ruskin
 - b. Greenheck
 - c. Pottorff
 - d. Nailor
 - e. Duro Dyne

2.3 PRESSURE DIFFERENTIAL GAUGES

- A. Pressure differential gauges for air filter application shall be dial type gauges. Range shall be appropriate for the application. Gradations shall read in inches w.c.
- B. Each gauge shall be furnished with vent valves, aluminum or plastic tubing, static pressure tips and mounting bracket or flange.
- C. Manufacturer
 1. Dwyer "Magnehelic" Series 2000 or approved equal.

2.4 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. METALAIRE, Inc.
 4. SEMCO Incorporated.
 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- E. Vane Construction: Single wall for ducts up to 36 inches wide and double wall for 36" wide and larger dimensions.

2.5 DUCT-MOUNTED ACCESS DOORS

- A. Duct Access Doors – Doors shall be factory fabricated with following characteristics:
1. Construction Material – Constructed of the same material as the ductwork system served (except galvanized sheet metal for fiberglass duct).
 2. Door Thickness – Doors located in:
 - a. Insulated ductwork (internal and/or external) shall have double-wall insulated doors, thickness as required per the insulation schedule.
 - b. Uninsulated ductwork shall have single-wall construction.
 3. Hinge – Continuous Piano Hinge. 1.5” wide steel construction, zinc plate.
 - a. Ventfabrics #Ventlok 157 or equal.
 4. Latches – Provide the following type of latch for each application:
 - a. Low pressure ductwork (1” w.c. or less) – Cam lock type latches.
 - b. High Pressure ductwork (greater than 1” w.c.) – Heavy duty handle type latches.
 5. Frame & Seal – Frame and neoprene gasket between door and frame.
 6. Size – Access doors shall be 18” x 16” minimum except smaller where duct size will not permit such size.
 7. Pressure Application – Access doors and panels shall be designed to provide tight seal commensurate with the duct system operating pressure. Apply duct sealer or rubber gasket between frame and duct and on ducts of 3” S.P. and higher construction class, mechanical fastening of the frame and rubber gasket shall be provided.
 8. Removable Sash Access Door – Where sufficient clearance is not available to allow the door to swing open 90 degrees or for round ductwork, a removable access panel with neoprene gasket, frame and cam lock latches on all four sides shall be provided in lieu of the hinged door.
- B. Large Plenum Access Doors – doors shall be factory fabricated and as described for duct access doors except that doors shall be 18” x 48” (unless otherwise noted) with overlapping frame,
1. Construction Material – Constructed of the same material as the ductwork system served (except galvanized sheet metal for fiberglass duct).
 2. Door Thickness – Doors located in:
 - a. Insulated ductwork (internal and/or external) shall have double-wall insulated doors, thickness as required per the insulation schedule.
 - b. Uninsulated ductwork shall have single-wall construction.
 3. Hinge – Continuous piano hinge. 2” wide steel construction, zinc plated. Ventfabrics #Ventlok 167 or equal.
 4. Latches – Heavy duty type. Lever both outside and inside. Ventfabrics #Ventlok No. 310 or equal.
 5. Latch Quantity – Two latches shall be provided, except on doors 50” and higher three shall be provided.
 6. Frame & Seal - Shall be mechanically fastened to the plenum wall.
 7. Pressure Application – Access doors and panels shall be designed to provide tight seal commensurate with the duct system operating pressure. Apply duct sealer or rubber gasket between frame and duct and on ducts of 3” S.P. and higher construction class, mechanical fastening of the frame and rubber gasket shall be provided.

2.6 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ventfabrics, Inc.
 - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 30 oz./sq. yd.
 - 2. Net Fabric Width: 4" wide.
 - 3. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 4. Service Temperature: Minus 40 to plus 200°F.

2.7 FLEXIBLE DUCTS

- A. Flexible insulated duct shall be constructed of galvanized steel spiral wire mechanically locked to an airtight aluminum or polyester inner core, 1" thick 3/4 lb. density fibrous glass insulation and a polyethylene or reinforced metalized vapor barrier outer jacket equal to Flexmaster Type 5 or 5M. Duct shall be rated at a minimum of 6" positive and 4" negative static pressure and shall be listed as Class 1 Air Duct or Air Duct Connector with 25-50 flame-smoke ratings per UL 181 and comply with NFPA 90A.
- B. Non-insulated flexible duct equal to Flexmaster NI-85 may be used on duct systems not specified to be insulated, with similar restriction stated above.
- C. Flexible duct shall be used at final connections to air control terminal units and ceiling air diffusers except as limited in Part 3.

2.8 SOUND ATTENUATORS

- A. Return Air Canopy
 - 1. Performance – ASHRAE, SMACNA pressure and velocity classifications and ASTM E477, ASTM E84 25/50 Flame/Smoke Spread
 - 2. Construction – 20-gauge solid steel casing, absorptive acoustic fiberglass acoustic media. Fiberglass to be shot-free inorganic glass fiber with long, resilient fibers, bonded with thermosetting resin.
 - 3. Manufacturer:
 - a. Price Industries
 - b. Titus
 - c. Tuttle & Bailey

PART 3 - EXECUTION

3.1 INSTALLATION

A. GENERAL

1. 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.
2. Materials – Install duct accessories of materials suited to duct materials use:
 - a. Galvanized-steel accessories in galvanized-steel and fibrous-glass ducts,
 - b. Stainless-steel accessories in stainless-steel ducts,
 - c. Aluminum accessories in aluminum ducts,
 - d. Or as noted above.

B. BACKDRAFT DAMPERS

1. Install at discharge of exhaust fans at least one half the fan diameter away from fan.

C. FIRE AND SMOKE DAMPERS

1. Fire and smoke dampers shall be installed in conformance with the manufacturer's instructions and SMACNA recommendations.
2. Dampers shall be installed in sheet metal wall or floor sleeves along with retaining angles and duct access doors or panels. Sleeve and duct connections shall be breakaway type or rigid type with corresponding gauge requirements in accordance with SMACNA recommendations.

D. VOLUME DAMPERS

1. Locations:
 - a. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts.
 - b. Install volume damper upstream/downstream of each supply, return or exhaust air device, register or grille.
 - c. Volume dampers shall be in accessible locations for testing, balancing, and adjusting purposes. Coordinate with reflected ceiling plans.
2. Lined Ductwork – 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.
3. Install steel volume dampers in steel ducts.
4. Install aluminum volume dampers in aluminum ducts.
5. Set dampers to fully open position before testing, adjusting, and balancing.

E. PRESSURE DIFFERENTIAL GAUGES

1. Install air filter pressure differential gauges in a readable location on or near the air handling unit, filter housing or as otherwise indicated on the drawings.

F. ACCESS DOORS

1. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - a. On both sides of duct coils.
 - b. Upstream / and downstream from duct filters.
 - c. At outdoor-air intakes and mixed-air plenums.
 - d. At drain pans and seals.
 - e. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - f. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - g. Control devices requiring inspection.
 - h. Elsewhere as indicated.
2. Install access doors with swing against duct static pressure to ensure closure.
3. Label access doors according to Division 23 Section "Identification for HVAC System" to indicate the purpose of access door.

G. FLEXIBLE CONNECTORS

1. Location: Install flexible connectors to connect ducts to equipment.
2. For fans developing static pressures of 5-inch w.g. and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

H. FLEXIBLE DUCTS

1. Connect flexible ducts to metal ducts with Panduit straps or stainless-steel clamps. End of the insulation and jacket shall be sealed to the metal duct with double wrapped duct tape. Maximum length of flexible duct shall be:
 - a. Terminal units to supply ducts – 3 ft.
 - b. Air devices to ducts – 7 ft.
2. Flexible duct installation locations:
 - a. Shall be installed:
 - 1) At final air devices above accessible ceilings.
 - b. Shall *not* be installed:
 - 1) Where ductwork is exposed.
 - 2) Above inaccessible ceilings – coordinate with reflected ceiling plan.
 - 3) Through any wall, ceiling, floor, or fire rated assembly.
 - 4) In the immediate vicinity of, and connecting to, air devices in fire rated ceilings where the assembly details require steel ductwork.

I. AIR BLENDERS

1. Air blender units shall be installed with sheet metal blank-offs to prevent by-passing. Units shall be installed in accordance with manufacturer's instructions with special consideration given to upstream and downstream clearances.

J. SOUND ATTENUATORS

1. Return Air Canopy – Install above return air device per manufacturer's recommendations in lieu of shop-fabricated plenum per detail.

END OF SECTION 23 3300

SECTION 23 3400 - FANS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Downblast Power Roof Ventilator.
 - 2. Upblast Power Roof Ventilator.
- B. Related Sections
 - 1. 23 0513 Electrical Requirements for HVAC Equipment
 - 2. 23 0548 Vibration Control

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Fans shall be constructed, rated and labeled in accordance with AMCA Standard 210-67. Fans shall be statically and dynamically balanced throughout the operating range.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Fans shall be provided as specified below and shown on the drawings, complete with motors, drives and associated devices.
- B. All fans of any one listed type shall be of the same manufacturer.
- C. Fan motors shall be direct drive, ECM type. Refer to Section 23 0513 Electrical Requirements for HVAC Equipment.
- D. Motor HP shall be sufficient to handle the full load of the fan, including drive losses, at the selected condition without exceeding the motor rating. In no case shall the motor size be less than shown without prior approval from the Engineer. All motors 1 HP and larger shall be “premium efficiency” series. Motors which are fed from variable frequency drive controllers for variable speed operation shall be designed and constructed for VFD drive duty and shall be compatible with the controller specified in Section 23 0531 Equipment Drives. Refer to Section 23 0513 Electrical Requirements for HVAC Equipment.
- E. Motorized backdraft dampers, where specified, shall be furnished with a 120V actuator. Refer to HOA controller details on HVAC drawings for additional information.
- F. All fans shall be provided with a Hand/Off/Auto controller from the unit manufacturer.

2.2 MOTORS

- A. Refer to Section 23 0513 - Electrical Requirements for HVAC Equipment

2.3 DOWNBLAST POWER ROOF VENTILATOR

- A. Construction – Power roof ventilator shall consist of a spun aluminum weather hood, counterflashing base, vertical shaft, open centrifugal wheel, **direct drive ECM**, motor disconnecting means in the motor compartment, motorized backdraft damper and bird screen.
- B. Finish – The exterior of the fan shall be galvanized.
- C. Mounting – A 14” high insulated metal roof curb with straight edges and wood nailer on top shall be provided with each fan. Provide wood cant strips around the curb only if recommended for the roofing system.
- D. Refer to the drawings for capacities, arrangement, class and other features and accessories. Fans shall be manufactured by:
 - 1. Greenheck
 - 2. Cook
 - 3. Carnes
 - 4. PennBarry

5. Twin City Fan

2.4 UPBLAST POWER ROOF VENTILATOR

- A. Construction – Upblast power roof ventilator shall consist of a spun aluminum weather hood with arrangement for upward discharge, counterflashing base, vertical shaft open centrifugal wheel, **direct drive ECM**, motor disconnecting means in the motor compartment
- B. Finish – The exterior of the fan shall be galvanized.
- C. Accessories – A motorized backdraft damper and bird screen shall be provided with each fan except that for kitchen range hood.
- D. Mounting – A 14” high insulated metal roof curb with straight edges and wood nailer on top shall be provided with each fan. Provide wood cant strips around the curb only if recommended for the roofing system.
- E. Refer to the drawings for capacities, arrangement, class and other features and accessories. Fans shall be manufactured by:
 - 1. Greenheck
 - 2. Cook
 - 3. Carnes
 - 4. PennBarry
 - 5. Twin City Fan

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fans and roof curbs level and plumb, in accordance with manufacturer’s written instructions.
- B. Support units as described below using the vibration control devices specified herein Section 23 0548 Vibration Control.
 - 1. Roof curb mounted units: Set unit on the curb and fasten the fan base to the curb.
- C. Arrange installation of fans to provide access space around fans for service and maintenance.
- D. Adjust damper linkages for proper damper operation. Motorized backdraft dampers are to be wired by the Electrical Contractor to open when the fan operates.
- E. Perform the following operations and checks before start-up.
 - 1. Remove shipping blocking and bracing.

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2. Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork and electrical are complete. Verify proper thermal overload protection is installed in motors starters and disconnects.
3. Verify proper motor rotation direction and verify fan wheel free rotation and smooth bearings operations. Align belts and reinstall belt guards.
4. Lubricate bearings, pulleys, belts and other moving parts with factory-recommended lubricants.
5. Verify manual and automatic volume control, and fire and smoke dampers in connected ductwork systems are in the full open position.

END OF SECTION 23 3400

SECTION 23 3600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Single-duct air terminal units

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.
- B. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: 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. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- D. Terminal units shall be certified to comply with ARI Standard 880.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Unit sizes (inlet duct dimension) shall conform to those listed on the drawings except where larger size is required (or smaller size is acceptable) to meet noise or operational requirements. Resultant noise level from the control unit, ductwork and diffusers, as a system, shall not exceed a room NC level of 25 from both airborne and radiated noise, based on a 10 db room absorption

coefficient, with 1.5" s.p. differential across the unit at maximum cfm setting. Sound performance shall be ARI certified.

- B. Pressure drop thru the terminal unit and hot water coil shall not exceed the maximum drop listed on the drawings. The coil face area shall be upsized if necessary to meet this requirement. The terminal unit casing shall be correspondingly upsized or the larger coil furnished separately. For a separately furnished coil and intervening duct transition, with internal insulation same as that in the terminal unit casing, shall be provided.

2.2 COMPONENTS AND ACCESSORIES

- A. Casing Construction – Unit casing shall be 22-gauge minimum thickness, galvanized or galvanized sheet metal with beaded round inlet duct connection. Provide galvanized construction for use in exposed locations for field application of paint.
- B. Casing Liner – Casing shall be lined internally with:
 - 1. Material – Unit casing liner shall be of the following construction:
 - a. Standard Construction – 1" thick, 4 p.c.f. dual density aluminum foil faced rigid fiberglass board/1" thick fiber free foam lining.
 - b. Mylar, Tedlar or similar facing materials are not acceptable.
 - 2. In lieu of foil facing, sheet metal liner may be provided.
 - 3. Acoustical considerations must be fully addressed.
 - 4. Performance – Minimum R-Value = 4.0.
 - 5. Sealing & Enclosure – Edges, joints and other exposures shall be additionally coated with approved sealants and/or protected with metal edging.
 - 6. Compliance – Insulation and facing lining shall meet:
 - a. UL 181 air erosion/ mold growth & humidity standards.
 - b. UL 723/NFPA 90A for 25/50 fire and smoke requirements.
 - c. ASTM C665 biological and fungi standards.
- C. Hot Water Reheat Coil
 - 1. Certifications – Coil shall have ARI certified ratings and shall be hydrostatically tested at 200 psi.
 - 2. Coil Construction – Coil shall consist of copper tubes, aluminum fins and galvanized steel casing. Coils shall be provided with appropriate fins per inch to satisfy the required scheduled capacity per the contract drawings.
 - 3. Air Vent – Provide a manual air vent on the coil.
 - 4. Hot water control valve shall be furnished by the Temperature Controls Contractor.
- D. Air Flow Control Damper or Valve – Damper or valve shall have linear control characteristics and shall be 16-gauge galvanized steel or extruded aluminum with gasketing and self-lubricating bearings.
- E. Velocity Sensor – Multi-point averaging type. The velocity sensor shall be mounted in the inlet air stream and shall amplify the air flow signal to provide accurate control at low, as well as high, inlet static pressure conditions. The required minimum static pressure of the volume regulator shall not exceed 0.25 in. w.g. for proper operation.

- F. Air Flow Taps – Taps and differential pressure airflow device shall be provided to enable direct reading of total and static pressures. A conversion chart shall be attached to each unit to convert pressure readings to air flow quantities.
- G. Bottom Access Doors – Units with a heating coil section shall be provided with an access door on the upstream side of the coil. Access doors shall be insulated type with edge seals and either snap or quarter-turn sash latches, screws will not be acceptable. Access doors shall be provided at the bottom of the unit unless otherwise noted.
- H. Air Leakage – Casing leakage and damper leakage shall each not exceed 2% of maximum air flow cfm at 3.0" s.p. differential across the unit.
- I. Controls Enclosure – Units installed in a return air plenum shall have a sheet metal housing to enclose non-plenum-rated control devices and wiring which are mounted on the exterior of the casing.

2.3 MANUFACTURERS

- A. Units shall be manufactured by:
 - 1. Price
 - 2. Titus
 - 3. Trane
 - 4. Tuttle & Bailey
 - 5. Enviro Tech

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Unit Supports – Support the units from the building structure with steel shapes, solid steel hanger rods or sheet metal strap hangers. Units shall not be supported by the ceiling suspension system.
- B. Unit Access Coordination
 - 1. Coordinate unit locations with ceiling components, light fixtures, and other equipment, services, elements or obstructions to ensure adequate clearance for access and servicing.
 - 2. Provide ceiling access panels where the ceiling system does not afford ready access.
 - 3. Coordinate right/left hand connections prior to placing order. Units ordered with coil connections and/or control enclosure boxes on inaccessible sides shall be re-ordered, the mounting of units "up-side-down" is not acceptable.
- C. Hot Water Connections – Connect supply and return piping to each hot water coil with shut-off valves, balancing valves, and unions. Provide a manual air vent at the coil. Automatic control valves shall be furnished by the Temperature Control Contractor and installed by the HVAC Contractor.
- D. Temperature Controls Devices

1. The Temperature Controls Contractor shall furnish the following:
 - a. The digital controller
 - b. Damper operator and linkage
 - c. Hot water control valve and piping accessories assembly.
 - d. Space temperature sensor
 - e. Duct mounted discharge air temperature sensor.
2. The digital controller, damper operator and linkage, furnished by the Temperature Controls Contractor, are to be sent to the terminal unit manufacturer for factory mounting. Coordinate accordingly.
3. Refer to the Temperature Control specification sections and Drawings for additional control devices and points and coordinate to provide a complete and operational system.

END OF SECTION 23 3600

SECTION 23 3713 - DIFFUSERS, REGISTERS, GRILLES AND LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Diffusers
2. Grilles
3. Registers
4. Louvers

B. Related Sections:

1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 23 Section 23 3300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, grilles, and return air canopies.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES AND REGISTERS

- A. Air outlet and inlet devices shall be equal to those specified by catalog number and description in the schedule on the drawings. Damper operators shall be concealed screw type. An auxiliary mounting frame shall be furnished with each grille and register except those mounted on exposed ducts or in lay-in application.

- B. Linear “T” bar air supply diffusers shall be slotted diffusers with fixed air pattern control complete with a galvanized sheet metal supply plenum having a round or oval duct connection and 1/2” neoprene coated fiberglass insulation on the interior. The unit shall be designed to mount on or alongside the ceiling “T” bar and shall include flanges on both sides of the diffuser to support the ceiling tiles. Additional “T” bars matching those of the ceiling system shall be provided by the HVAC Contractor if the diffuser does not have these flanges. Units shall have a center notch where required to accommodate intervening “T” bars.
- C. Manufacturers:
 - 1. Price
 - 2. Titus
 - 3. Tuttle & Bailey
 - 4. Krueger

2.2 LOUVERS

- A. Louvers shall be exterior weatherproof, equal to those scheduled and shown on the drawings. Louvers shall be assembled entirely by welding. Louvers shall withstand uniform wind loading pressure of 20 psf. Performance data indicating pressure loss and water penetration, derived from AMCA 500 testing, shall be included with submittals.
 - 1. Construction – Extruded 12 ga. aluminum frame and stationary, drainable blades.
 - 2. Finish – R1 caustic etch and finished with Kynar 500 (or equivalent) fluoropolymer finish. Color is to be selected by the Architect from the manufacturer’s standard colors.
 - 3. Accessories – ½” black square mesh aluminum wire bird screen on the interior face of the louver attached at 12” centers on the perimeter.
- B. Manufacturers:
 - 1. Airolite
 - 2. Greenheck
 - 3. Pottorff
 - 4. Ruskin

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Ceiling System Verification – The Contractor shall be responsible for comparability of ceiling mounted devices with the ceilings and suspension systems (lay-in, concealed spline, plaster, drywall, etc.). Verify with architectural drawings.
- B. Alignment and Supports – Carefully align square and rectangular devices with the vertical and horizontal building lines. Diffusers shall be attached rigidly to the ductwork. Where connected

by flexible ducts, special supports shall be provided as required, either from the ceiling suspension system or by independent suspension wires or rods from the building structure.

- C. Painting – Paint interior visible surfaces of ductwork behind grilles, registers, diffusers and louvers flat black, as needed, to eliminate the sight of shiny surfaces.
- D. Air Balancing – Each ducted air device shall be provided with a balancing damper, located either at the run-out duct to the final air device for accessible locations or an integral damper at the air device for inaccessible locations. Transfer air devices are not required to have balance dampers, unless noted. Duct mounted air devices shall be provided with standoff frame and integral balance damper or scoop style damper, as noted. Refer to drawings for other specific instances.
- E. Fire and/or Smoke Dampers – Where required, provide integral fire or smoke dampers with air devices when devices are in fire and/or smoke walls and as required by code.
- F. Louvers
 - 1. Exterior louvers shall be provided and installed by the HVAC Contractor in cooperation with the General Contractor.
 - 2. Install louver assemblies in strict accordance with manufacturer's recommendations. Louvers to be installed plumb, square, level and true.
 - 3. Seal perimeter of louver with exterior grade caulk to match louver color.
 - 4. Paint visible ductwork behind louvers black with exterior grade primer and paint.

END OF SECTION 23 3713

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SECTION 23 3723 - GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of roof-mounting intake and relief ventilators:
 - 1. Louver penthouses.
 - 2. Goosenecks.
- B. See Division 08 Section "Louvers and Vents" for ventilator assemblies provided as part of the general construction.
- C. See Division 23 Section 23 400 for roof-mounting exhaust fans.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: Include plans, elevations, sections, details, and ventilator attachments to curbs and curb attachments to roof structure.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) zinc coating, mill phosphatized.
- D. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

2.2 FINISHES

- A. Exterior of the ventilator shall be:
 - 1. Primed and factory finished with semi-gloss enamel of color selected by the Architect.

2.3 LOUVER PENTHOUSES

- A. Manufacturers:
 - 1. Acme Engineering & Mfg. Corp.
 - 2. Aerovent; a Twin City Fan Company.
 - 3. Carnes.
 - 4. Greenheck.
 - 5. JencoFan.
 - 6. Loren Cook Company.
 - 7. Penn Ventilation.
- B. Construction: Aluminum construction with heavy gauge extruded aluminum louvers on four sides with mitered and welded corners, reinforcing channels on the interior, sheet aluminum top and counterflashing angled up on the inside to afford additional weather protection and condensation troughing.
- C. Filters: 2" channels with 2" washable aluminum mesh filters and hinged top for accessibility.
- D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; rigid fiberglass insulation adhered to inside walls; and wood nailer. Size as required to fit roof opening and ventilator base.
 - 1. Configuration: Wood cant strips around the curb only if recommended for the roof system. Match roof slope so that the top of the curb is level.
 - 2. Overall Height: 20 inches.
- E. Bird Screening: Aluminum, 1/2-inch square mesh.
- F. Backdraft Dampers: Set within roof curb, furnished with the ventilator.
 - 1. Counterbalanced gravity type.

2.4 GOOSENECKS

- A. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 5-5; with a minimum of 0.052-inch thick, galvanized-steel sheet.
- B. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; rigid fiberglass insulation adhered to inside walls; and wood nailer. Size as required to fit roof opening and ventilator base.
 - 1. Configuration: Wood cant strips around the curb only if recommended for the roof system. Match roof slope so that the top of the curb is level.

- 2. Overall Height: 20 inches.
- C. Bird Screening: Aluminum, 1/2-inch square mesh.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install intake and relief ventilators level, plumb, and at indicated alignment with adjacent work.
- B. Secure intake and relief ventilators to roof curbs with cadmium-plated hardware. Use concealed anchorages where possible. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.
- C. Install intake and relief ventilators with clearances for service and maintenance.
- D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- F. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- G. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories.
- H. Adjust damper linkages for proper damper operation.
- I. Vent air units shall have the underside of the hood insulated to prevent condensation of the vent air on the underside of the hood.

END OF SECTION 23 3723

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SECTION 23 5100 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Listed double-wall vents and chimneys.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Building-heating-appliance chimneys.
- B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, diagrams, and attachments to other work. Provide submittals for all fittings, terminations and vents.

PART 2 - PRODUCTS

2.1 LISTED SPECIAL GAS VENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Heat-Fab, Inc.
 - 2. Metal-Fab, Inc.
 - 3. Metalbestos.
 - 4. Van-Packer Model CS Type BH
- B. Description: Double-wall metal vents tested according to UL 1738 (condensing) and rated for 1000 deg F continuously, or 1700 deg F for 10 minutes; with positive flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 1-inch air space.
- D. Inner Shell: AL 29-4C or 29-4 (S44735) superferritic stainless steel.

- E. Outer Jacket: 316 Stainless steel.
- F. Pressure: Vent shall be listed for an internal static pressure of 15" w.g. and tested to 37" w.g.
- G. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
 - 1. Tees and elbows: Shall provide a pressure drop less than 15 feet equivalent horizontal vent.
 - 2. Joints: Inner wall joints shall be designed with a male and female overlapping metal-metal connection to maintain condensate on the AL29-4C stainless steel.
 - 3. Gaskets/Sealant: A factory installed 550°F compatible silicone rubber gasket shall be used to seal joints.
 - 4. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.
- H. Compliance: System is to be sized in accordance with the appliance manufacturer's specifications, NFPA 54-National Fuel Gas Code (ANSI Z223.1), ASHRAE recommendations, and other applicable codes.

PART 3 - EXECUTION

3.1 INSTALLATION OF LISTED VENTS AND CHIMNEYS

- A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- B. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- C. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
- D. Lap joints in direction of flow.
- E. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.
- F. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
- G. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION 23 5100

SECTION 23 5216 - CONDENSING BOILERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, water-tube condensing boilers, trim, and accessories for generating heating hot water.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and wiring diagrams.
- C. Efficiency Curves: At a minimum, submit efficiency curves for 100%, 80%, 60%, 40%, 20% and 7% input firing rates at incoming water temperatures ranging from 80 deg. F to 170 deg. F.
- D. Pressure Drop Curve. Submit pressure drop curve for flows ranging from 0 GPM to maximum boiler flow.
 - 1. Should submitted material be different from that of the basis of design, the boiler manufacturer shall incur all costs associated with reselection of necessary pumps.
- E. Source quality-control test reports.
- F. Field quality-control test reports.
- G. Operation and maintenance data.
- H. Warranty: Standard warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

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- B. I=B=R Performance Compliance: Condensing boilers shall be rated in accordance with applicable federal testing methods and verified by AHRI as capable of achieving the energy efficiency and performance ratings as tested within prescribed tolerances.
- C. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers".
- D. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil-Fired Boilers - Minimum Efficiency Requirements."
- E. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."
- F. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.
- G. NOx Emission Standards: When installed and operated in accordance with manufacturer's instructions, condensing boilers shall comply with the NOx emission standards outlined in South Coast Air Quality Management District (SCAQMD), Rule 1146.1; and the Texas Commission on Environmental Quality (TCEQD), Title 30, Chapter 117, Rule 117.465.

1.5 WARRANTY

- A. Standard Warranty: Boilers shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Water-Tube Condensing Boilers:
 - a. The pressure vessel/heat exchanger shall carry a 10-year non-prorated warranty from date of start up against any failure due to condensate corrosion, thermal stress, mechanical defects or workmanship.
 - b. Manufacturer labeled control panels shall be warranted against failure for two (2) years from start up.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Patterson-Kelley – P-K Sonic
 - 2. Fulton – Endura XE
 - 3. Laars – Neotherm
 - 4. Aerco – Benchmark

2.2 CONSTRUCTION

A. Description:

1. Boiler shall be natural gas fired, fully condensing, water tube design. Power burner shall have full modulation with a minimum 5:1 turndown ratio, and discharge into a positive pressure vent. Boiler efficiency shall increase with decreasing load (output), while maintaining setpoint. Boiler shall be factory-fabricated, factory assembled and factory tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base, including insulated jacket, flue-gas vent, combustion air intake connections, water supply, return and condensate drain connections, and controls.

B. Heat Exchanger:

1. The heat exchanger shall be constructed of 316L stainless steel fire tubes and tube sheets, with a one-pass combustion gas flow design. The pressure vessel/heat exchanger shall be welded construction. The heat exchanger shall be ASME "H" stamped for a working pressure not less than 160 psig.
2. Access to the tube sheet and heat exchanger shall be available by burner and exhaust manifold removal. Minimum access opening shall be not less than 10-inch diameter.

C. Pressure Vessel:

1. The pressure vessel shall have a maximum water volume of 50 gallons. The water pressure drop shall not exceed 10 ft. hd. at 40 GPM. The boiler water connections shall be 4-inch flanged 150-pound, ANSI rated. The pressure vessel shall be constructed of SA53 carbon steel, with a 0.25-inch thick wall and a 0.50-inch thick upper head.
2. Inspection openings in the pressure vessel shall be in accordance with ASM Section IV pressure vessel code.

D. Modulating Air/Fuel Valve and Burner:

1. The boiler shall incorporate a forced draft burner and be capable of a minimum of 5:1 turndown ratio of the firing rate without loss of combustion efficiency or staging of gas valves.
2. The burner shall produce less than 30 ppm of NO_x corrected to 3% excess oxygen. The unit shall be certified by the South Coast Air Quality Management District (SCAQMD) as compliant with Rule 1146.1 for boilers and water heaters greater than 2 MBTU's and less than 5MBTU's.
3. The burner shall be metal-fiber mesh covering a stainless-steel body with spark ignition and flame rectification. All burner material exposed to the combustion zone shall be stainless-steel construction. There shall be no moving parts within the burner itself.
4. A modulating air/fuel valve shall meter the air and fuel input. The modulating motor shall be linked to both the gas valve body and air valve body with a single linkage. The linkage shall not require any field adjustment.
5. A variable frequency drive (VFD), controlled cast aluminum pre-mix blower shall be used to ensure the optimum mixing of air and fuel between the air/fuel valve and the burner.

E. Exhaust Manifold:

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1. The exhaust manifold shall be of corrosion resistant cast aluminum with an 8-inch diameter flue connection. The exhaust manifold shall have a collecting reservoir and a gravity drain for the elimination of condensation.

F. Blower:

1. The boiler shall include a variable speed, DC centrifugal fan to operate during the burner firing sequence and pre-purge the combustion chamber.

G. Ignition:

1. Ignition shall be via spark ignition with 100 percent main-valve shutoff and electronic flame supervision.

2.3 TRIM

- A. Safety Relief Valve: ASME rated. 50 PSIG.
- B. Drain Valve: Minimum 0.75" hose-end ball valve.

2.4 CONTROLS

- A. The boiler control package shall be an integrated boiler management system capable of receiving signals from the building DDC system. The controls system shall be integral to each boiler, creating a control network that eliminates the need for a "wall mounted" stand-alone boiler control system.
- B. The boiler management control shall be capable of operating in the following ways:
 1. As a standalone boiler control system using its own control protocol with one "Master" and multiple "Member" units.
 2. As a boiler network, enabled by a Building Management System, using its own protocol with one "Master" and multiple "Member" units.
 3. As "Member" boilers to a Building Management System with multiple input control methods.
- C. Each boiler control panel shall be networked together and shall have the following standard features.
 1. Digital Communications Control
 - a. Boiler to Boiler: control panel protocol.
 - b. Building Management System: BACnet MS/TP or Lon Work, coordinate with DDC system.
 2. Analog 4-20 mA and 0-10V DC also supported.
 3. Distributed control using boiler protocol for up to 16 total boilers.

4. System/Boiler operating status in English text display.
5. Interlock, Event, and System logging with a time stamp.
6. Advanced PID algorithm optimized for specific boilers.
7. Four (4) dedicated temperature sensor inputs for: Outside Air Temperature, Supply (Outlet) Temperature, Return Temperature (Inlet), and Header Temperature.
8. Automatically detects the optional temperature sensors on startup.
9. Menu driven calibration and setup menus with display.
10. Eight (8) dedicated 24vac interlock monitors and eight (8) dedicated 120vac system monitors used for diagnostics and providing feedback of faults and system status.
11. Multiple boiler pump or motorized valve control modes.
12. Combustion Air Damper control with proof time.
13. USB/RS485 network plug-in to allow firmware updates or custom configurations.
14. BACnet or LonWorks interface.
15. Alarm contacts.
16. Runtime hours.
17. Outdoor Air Reset with programmable ratio.
18. Time of Day clock to provide up to four (4) night setback temperatures.
19. Failsafe mode when a Building Management System is controlling setpoint. If communication is lost, the boiler/system shall run off the local setpoint.

2.5 ELECTRICAL POWER

- A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.
- B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

2.6 VENTING KITS

- A. Exhaust Vent –
 1. The exhaust vent shall be UL listed for use with Category III and IV appliances and compatible with operating temperatures up to 480 degrees F, positive pressure, condensing flue gas service.

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2. Refer to Section 23 5100 – Breechings, Chimneys and Stacks, for required UL-listed vents of AL 29-4C stainless steel products.
3. Minimum exhaust vent duct size for each boiler – Refer to Boiler Schedule.

B. Combustion Air Intake –

1. Boilers shall be capable of drawing combustion air from outdoors via:
 - a. Galvanized sheet metal pipe or
 - b. Schedule 40 CPVC duct
2. Minimum Combustion Air Duct Size – Refer to Boiler Schedule.

2.7 SOURCE QUALITY CONTROL

- A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

PART 3 - EXECUTION

3.1 BOILER INSTALLATION

- A. Install boilers level on concrete base. The concrete base shall be installed by the HVAC contractor.
- B. Install gas-fired boilers according to NFPA 54.
- C. Assemble and install boiler trim.
- D. Install electrical devices furnished with boiler but not specified to be factory mounted.
- E. Install control wiring to field-mounted electrical devices.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Piping Connections
 1. Install piping adjacent to boiler to allow service and maintenance.
 2. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve.
 3. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
 4. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

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5. Install piping from safety relief valves to nearest floor drain.
6. Route condensate piping to the nearest floor drain and provide an acid neutralizing cartridge kit prior to discharge into floor drain.

C. Boiler Combustion Air & Venting:

1. Install boiler flue venting product and combustion-air intake ductwork.
2. Route to the exterior of the building per drawings.
3. Maintain minimum required clearances for vent outlets to building ventilation inlet such as outdoor intake louvers/hoods, doors or operable windows.
4. Venting shall be provided with condensate traps as required by the boiler manufacturer. Pipe traps to condensate neutralizing cartridge prior to floor drain.

D. Electrical Connections

1. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
2. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

E. Temperature Controls

1. Refer to Section 23 0993 – Sequence of Operations for Controls – For control sequences, device connections and operation of system.
2. Refer to Section 23 0914 – Control Wiring and Cabling for required temperature control wiring of boiler.
3. Connect related control devices as noted on drawings to the respective boiler control panel. Connect each boiler to the main boiler control panel.
4. Connect the main boiler control panel to the dedicated facility DDC system JACE 9000 controller.

3.3 FIELD QUALITY CONTROL

A. 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.

B. Tests and Inspections

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
 - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

- C. Remove and replace malfunctioning units and retest as specified above.
- D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion. Provide on-site assistance in adjusting the system to suit actual occupied conditions. Provide up to two visits to the Project during other than normal occupancy hours for this purpose.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION 23 5216

SECTION 23 6426 – AIR COOLED WATER CHILLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Packaged air-cooled chillers.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Include plans, elevations, sections, details, clearance requirements and electrical requirements.
- C. Startup service reports.
- D. Operation and maintenance data.
- E. Warranty.

1.4 QUALITY ASSURANCE

- A. Chiller rating and performance shall be according to requirements of current ARI 550/590 standards.
- B. ASHRAE Compliance:
 - 1. ASHRAE 15 for safety code for mechanical refrigeration.
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2019
- D. Comply with NFPA 70.
- E. Unit shall be UL or ETL listed.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.
 - 1. Extended warranties include, but are not limited to, the following:
 - a. Complete compressor and drive assembly
 - 2. Warranty Period: Five years from date of Substantial Completion. First year labor: Parts & Compressor, four years extended compressor warranty, parts & labor.
 - 3. Refrigerant Warranty: One-year R32 refrigerant.

PART 2 - PRODUCTS

2.1 PACKAGED, AIR-COOLED CHILLERS

- A. Manufacturers: Subject to compliance with requirements
 - 1. Daikin AGZ, or equal by:
 - 2. Trane
 - 3. York.
- B. Description: Factory-assembled and run-tested chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
- C. Fabricate base, frame, and attachment to chiller components strong enough to resist chiller movement during a seismic event when chiller base is anchored to field support structure.
- D. Cabinet:
 - 1. Base: Galvanized-steel base extending the perimeter of chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
 - 2. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported by base.
 - 3. Casing: Galvanized steel.
 - 4. Finish: Base, frame, and casing shall be finished with an enamel paint finish.
 - 5. Sound-reduction package designed to reduce sound level without affecting performance and consisting of the following:
 - a. Acoustic jacket enclosure around compressors.
- E. Compressors- Scroll:
 - 1. Hermetically sealed, direct drive fixed compression scroll design.

2. Each compressor to have centrifugal oil pump, oil level sight glass, oil charging valve and check valve on the discharge.
 3. Motor shall be two pole, squirrel cage induction type, 3600 rpm.
 4. Multiple compressors staged on-off for capacity control, minimum of four compressors and dual refrigerant circuits.
- F. Service: Easily accessible for inspection and service.
- G. Capacity Control: On-off compressor cycling and or modulating slide-valve assembly to achieve performance indicated.
1. Maintain stable operation throughout range of operation from 20% to 100% of capacity. Configure to achieve most energy-efficient operation possible.
 2. For units equipped with a variable frequency controller, capacity control shall be both "valveless" and "stepless," requiring no slide valve or capacity-control valve(s) to operate at reduced capacity.
- H. Oil Lubrication System: Consisting of pump if required, filtration, heater, cooler, factory-wired power connection, and controls.
1. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.
 2. Thermostatically controlled oil heater properly sized to remove refrigerant from oil.
 3. Factory-installed and pressure-tested piping with isolation valves and accessories.
 4. Oil compatible with refrigerant and chiller components.
 5. Positive visual indication of oil level.
- I. Vibration Control:
1. Vibration Balance: Balance chiller compressors and drive assemblies to provide a precision balance that is free of noticeable vibration over the entire operating range.
 - a. Overspeed Test: 25 percent above design operating speed.
 2. Isolation: Mount individual compressors on vibration isolators.
- J. Compressor Motors:
1. Hermetically sealed and cooled by refrigerant suction gas.
 2. High-torque, induction type with inherent thermal-overload protection on each phase.
- K. Compressor Motor Controllers:
1. Across the Line: NEMA ICS 2, Class A, full voltage, non-reversing, or solid state.
 2. Star-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed transition, or solid state.
- L. Refrigerant Circuits:

1. Refrigerant: Type as indicated on Drawings.
2. Refrigerant Circuit: Each shall include refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
3. Pressure Relief Device:
 - a. Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - b. ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type.

M. Evaporator:

1. Description: Brazed Plate to Plate.
 - a. Direct Expansion, single pass, brazed plate design.
 - b. Type 316 Stainless Steel construction.
2. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Fluid Nozzles: Terminated with mechanical-coupling end connections for connection to field piping.
4. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.

N. Air-Cooled Condenser:

1. Plate-fin coil with integral subcooling on each circuit.
 - a. Construct coil casing of galvanized steel.
 - b. Construct coils of copper tubes mechanically bonded to aluminum fins.
2. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
3. Fan Motors: Totally enclosed non-ventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings. Equip each motor with overload protection integral to either the motor or chiller controls.
4. Fan Guards: Steel safety guards with corrosion-resistant coating.
5. Coil Hail Guards: Steel louvered condenser coil guards.

O. Electrical Power:

1. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point, field-power connection to chiller.
2. House in a unit-mounted, NEMA 250, Type 3R enclosure with hinged access door
3. Wiring shall be numbered and color-coded to match wiring diagram.
4. Install factory wiring outside of an enclosure in a raceway.
5. Field-power interface shall be to wire lugs

6. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - b. NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.
7. Provide each motor with overcurrent protection.
8. Overload relay sized according to UL 1995 or an integral component of chiller control microprocessor.
9. Phase-Failure and Undervoltage Relays: Solid-state sensing with adjustable settings.
10. Control Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - a. Power unit-mounted controls where indicated.
 - b. Power unit-mounted, ground fault interrupt (GFI) duplex receptacle.
11. Control Relays: Auxiliary and adjustable time-delay relays.
12. For chiller electrical power supply, indicate the following:
 - a. Current and phase to phase for all three phases.
 - b. Voltage, phase to phase, and phase to neutral for all three phases.
 - c. Three-phase real power (kilowatts).
 - d. Three-phase reactive power (kilovolt amperes reactive).
 - e. Power factor.
 - f. Running log of total power versus time (kilowatt-hours).
 - g. Fault log, with time and date of each.

P. Controls:

1. Microprocessor based
2. Enclosure: Share enclosure with electrical power devices.
3. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units, display the following information:
 - a. Date and time.
 - b. Operating or alarm status.
 - c. Operating hours.
 - d. Outdoor-air temperature if required for chilled-water reset.
 - e. Temperature and pressure of operating set points.
 - f. Entering and leaving temperatures of chilled water.
 - g. Refrigerant pressures in evaporator and condenser.
 - h. Saturation temperature in evaporator and condenser.
 - i. No cooling load condition.
 - j. Elapsed time meter (compressor run status).
 - k. Pump status.
 - l. Antirecycling timer status.
 - m. Percent of maximum motor amperage.

- n. Current-limit set point.
 - o. Number of compressor starts.
 - p. Normal or Ice making mode of operation.
4. Control Functions:
- a. Manual startup and shutdown.
 - b. Entering and leaving chilled-water temperatures, control set points, and motor load limits. Chilled-water leaving temperature shall be reset from the DDC system
 - c. Current limit and demand limit.
 - d. External chiller emergency stop.
 - e. Anti recycling timer.
 - f. Automatic lead-lag switching.
5. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:
- a. Low evaporator pressure or high condenser pressure.
 - b. Low chilled-water temperature.
 - c. Refrigerant high pressure.
 - d. High or low oil pressure.
 - e. High oil temperature.
 - f. Loss of chilled-water flow.
 - g. Control device failure.
6. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
7. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
8. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
9. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, initiate/terminate ice building mode and display chiller status and alarms. BACnet MS/TP or BACnet IP.
- a. Hardwired Points:
 - 1) Monitoring: On-off status, common trouble alarm
 - 2) Control: On-off operation, chilled-water, discharge temperature set-point adjustment, normal/ice making mode of operation
 - b. Coordinate communication interface with the DDC shall enable the DDC operator to remotely control and monitor the chiller from an operator workstation. Major control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.

Q. Insulation:

- 1. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

2. Thickness: 1-1/2 inches.
3. Factory-applied insulation over cold surfaces of chiller components.
 - a. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
4. Apply protective coating to exposed surfaces of insulation to protect insulation from weather.

R. Accessories:

1. Factory-furnished, chilled-water flow switches for field installation.
2. Individual compressor suction and discharge pressure gauges with shutoff valves for each refrigerant circuit.

2.2 SOURCE QUALITY CONTROL

- A. Perform functional tests of chillers before shipping.
- B. Factory test and inspect evaporator according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 3 - EXECUTION

3.1 CHILLER INSTALLATION

- A. Install chillers on grade mounted concrete pad provided by the General Contractor. Mount support points with neoprene isolation pads.
- B. Maintain manufacturer's recommended clearances for service and maintenance.
- C. Charge chiller with refrigerant and fill with oil if not factory installed.
- D. Install separate devices furnished by manufacturer and not factory installed.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 23 Section "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to chiller to allow service and maintenance.
- C. Evaporator Fluid Piping Connections: Connect to evaporator inlet with shutoff valve, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage and drain connection with valve. Make connections to chiller with a mechanical coupling.

- D. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that refrigerant charge is sufficient and chiller has been leak tested.
 - 3. Verify that pumps are installed and functional.
 - 4. Verify that thermometers and gages are installed.
 - 5. Operate chiller for run-in period.
 - 6. Check bearing lubrication and oil levels.
 - 7. For chillers installed indoors, verify that refrigerant pressure relief device is vented outdoors.
 - 8. Verify proper motor rotation.
 - 9. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.
 - 10. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser.
 - 11. Verify and record performance of chiller protection devices.
 - 12. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- E. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.
- F. Prepare test and inspection startup reports.

END OF SECTION 23 6426

SECTION 23 7313 - MODULAR INDOOR AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Factory assembled air handling units.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

A. Product Data: For each air-handling unit indicated.

1. Unit dimensions and weight.
2. Cabinet material, metal thickness, finishes, insulation, and accessories.
3. 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.
4. Certified coil-performance ratings with system operating conditions indicated.
5. Dampers, including housings, linkages, and operators.
6. Filters with performance characteristics.

B. Operation and maintenance data.

1.4 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.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
- C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Startup."
- E. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- F. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 UNIT CASINGS

- A. Casings to house the various components shall be double wall as indicated on the drawings. Sections shall have bolted intervening connections. Casings and parts shall be galvanized sheet steel throughout, or sheet steel chemically cleaned, phosphatized and painted on the exterior with enamel. Side panels of all modular sections shall be removable with two or more camlock type locks, fully gasketed around the entire perimeter of the panel. The panel size should be large enough to allow maintenance and or replacement of internal components.
- B. Double Wall
 - 1. 2" thick panels, solid metal inside and out
 - 2. Insulation: 2" spray injected foam = R-13
- C. Access Doors:
 - 1. Access Doors:
 - a. 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 air-pressure differential.
 - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - a. Construction: Double wall insulated.
 - b. All doors shall have glass vision panels.
 - c. Doors shall be 6" shorter than the height of the unit, or 72" max. height.
 - 2. Locations:
 - a. Access doors shall be provided at a minimum in the following locations and where otherwise indicated on the drawings
 - b. Verify that the sections listed below are large enough for panels and doors. Verify applicability with listed manufacturers.
 - c. Fan Sections
 - d. Access Sections
 - e. Cooling Coil Drain Pan
 - f. Filter Section
 - g. Mixing Section
 - h. Humidifier Section.
 - i. Heat Wheel Section

D. Interior Lighting.

1. Unit manufacturer shall furnish, install and wire a complete lighting system to one (1) identified 120-volt feed location. The lighting system should include light fixtures, switches and a GFCI receptacle per the following:
 - a. LIGHT FIXTURES for unit section: Vapor tight LED marine type guarded service light fixture. Each access section shall be provided with a minimum of one (1) light fixture. Fan sections and filter sections shall be provided with a minimum of two (2) light fixtures.
 - b. LIGHT SWITCHES: 20-amp, single pole, specification grade, toggle switch in lug type device box with stainless steel cover plate.
 - c. GFCI CONVENIENCE OUTLETS (Outdoor Units Only). 20-amp, specification grade, NEMA 5-20R, duplex receptacle in lug type device box with stainless steel cover plate. Unit to be provided with one (1) convenience outlet on unit exterior at each fan section and one (1) centered inside the access chase.
 - d. Locations: As noted on drawings.

E. Base Rail

1. The casing sections shall be assembled on full length heavy gauge galvanized steel base rails, 6" high.

2.2 FAN, DRIVE, AND MOTOR SECTION

A. ECM Fan Array

1. Fan section(s) shall contain, fan, motor, drive components and accessories. Motor and drive shall be mounted with the casing and isolated. Fan shall be airfoil type with electronically commutated motor (ECM). See fan duty and HP requirements listed on the drawings.
2. An integrated drive should be provided for each fan array. Drive to be mounted on door side of fan section and to include fused disconnect with a motor starter. Drives are to be accessible through a hinged door assembly complete with a single handle latch. The unit manufacturer shall install all power and control wiring.
3. The drive output shall be controlled by the factory installed main unit control system and drive status operating speed shall be monitored and displayed at the main unit control panel. The supply and exhaust fan drive outputs shall be independently controlled in order to provide the control needed to maintain building pressure control.
4. All drives shall be factory run tested prior to unit shipment.
 - a. The fan array will be arranged with high performance direct drive, single inlet, plenum fans with backwards inclined, high efficiency welded-aluminum or high-performance composite impeller with galvanized or aluminum support frame. Manual blank-off plates shall be provided to block fan airflow, one plate to be provided per array. Backdraft dampers shall be provided to block fan airflow in lieu of blank-off plates.

- b. The fans are driven by long-life, low-temperature brushless DC electronically commutated motor (EC-Motor) with external rotor and integrated maintenance-free electronic circuitry and electronics. The motor is manufactured with maintenance-free, permanently lubricated ball bearings and shall be statically and dynamically balanced in accordance with ISO 1940 part 1. The motor shall be closed, protection level IP 54, thermal class 155 with permissible operating temperature of -13°F to 140°F. Motor efficiency class shall comply with IE4. Fan characteristic curves indicate measurements on a chamber test in accordance with ISO5801. The three phase external rotor motor integrated into the fan hub meets the requirements for circulating electric machines set forth in DIN EN 60 034-1 (VDE 0530 Part 1).
 5. The fan bulkhead wall shall be constructed of minimum 1" foam injected panel. The panels walls shall be minimum 20-gauge galvanized metal and add structure to prevent vibration and "oil canning" of bulkhead wall. Bulkhead walls constructed of non-insulated sheet metal assemblies shall not be acceptable.
 6. ECM Motors: Provide a single control panel consisting of motor overloads, one for each fan, and DDC control input for fan modulation. All power and control wiring from control panel shall be provided by the unit manufacture as specified above. Panel shall be designed and wired to accept a single point power and controls connection by the respective trade contractors.
- B. Motor shall be "premium efficiency" series. Refer to Section 23 0513 Electrical Requirements for HVAC Equipment.
1. Motors which are fed from variable frequency drive controllers for variable speed operation shall be designed and constructed for VFD drive duty and shall contain shaft grounding rings by Aegis.
 2. Vibration isolation of the fan and motor assembly shall be internal to the fan casing. Vibration isolators shall be steel spring type, 2" static deflection.
 - a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
 - b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

2.3 COIL SECTIONS

- A. General Requirements for Coil Sections:
1. Comply with ARI 410.
 2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
 3. For multizone units, provide air deflectors and air baffles to balance airflow across coils.
 4. Coils shall not act as structural component of unit.
- B. Heating Coils

1. Heating coil(s) shall be hot water type with copper tubes with 0.020", 0.024", 0.018" minimum wall thickness, aluminum fins, supply and return headers and galvanized steel casing.

C. Cooling Coils

1. Cooling coil(s) shall be chilled water type with copper tubes with 0.020", 0.024", 0.018" wall thickness, aluminum fins, supply and return headers and stainless steel casing.
2. A drain pan shall be incorporated in sections containing cooling coils, heating coils, first section downstream of cooling coil, outside air intake openings, access sections between coils and other sections so noted on the drawings. Drain pan shall be double wall with insulation between. Interior liner shall be stainless steel for cooling coils, others shall be galvanized steel. Drain pan shall be sloped in two directions and have a tapped drain outlet at that side of the pan.

2.4 AIR FILTRATION SECTION

- A. Filter types and efficiencies shall be as indicated in the Air Handling Unit Schedule and details. Filter dimensions shall be 12"x24" or 24"x24".
- B. Filter bank shall be designed for a maximum face velocity of 500 fpm.
- C. Two complete sets of pre-filters and two complete sets of final filters shall be provided by the air handling unit manufacturer for each unit.
- D. Filters shall be shipped direct to the job site independent of the air handling unit.
- E. Pre-Filters
 1. Minimum efficiency of MERV 9, in accordance with ASHRAE 52.1
 2. Pre-filters shall be 2" deep.
 3. Disposable cartridges fabricated of reinforced synthetic fibers bonded to a resistant water resistant and incombustible carton frame.
 4. Manufactured according to the standards established by UL class II.
 5. Pre-filters shall be Camfil-Farr 30/30 or equal by AAF.
- F. Final Filters
 1. Minimum efficiency of MERV 13, in accordance with ASHRAE 52.1
 2. Final filters shall be 12" deep.
 3. Disposable cartridges fabricated of reinforced synthetic fibers bonded to a resistant water resistant and incombustible carton frame.
 4. Manufactured according to the standards established by UL class II.
 5. Final filters shall be Camfil-Farr Riga-Flo or equal by AAF.

2.5 MIXING SECTION

- A. The mixing section shall consist of a casing with outside air dampers, vent air dampers and return air dampers. Dampers shall be aluminum air foil blades equipped with external linkage for automatic control, vinyl or neoprene blade edge seals and metal compressible jamb seals. AMCA certified with a maximum leakage of 12 cfm/sq.ft at 4" w.g. differential pressure. Maximum blade length shall be 60 inches. Mixing section and filter section may be combined into a single section only where specifically indicated on the drawings. Provide access doors as indicated on the drawings or as required for damper access.
- B. Arrangement of outside air dampers and return air dampers shall be:
 - 1. Outside Air Damper: Parallel blade
 - 2. Return Air Damper: Parallel blade
- C. Air blenders consisting of fixed blade devices that rotate and mix air streams shall be incorporated in a casing section along with sheet metal baffling. Air blenders shall be fabricated of sheet aluminum or galvanized steel, all welded construction. Casing shall be sufficient length for required upstream and downstream clearances to accomplish a resulting mixed air temperature within 6 degrees F. of theoretical.

2.6 MANUFACTURERS

- A. Manufacturers:
 - 1. Daikin
 - 2. Trane
 - 3. York

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment Base – Each floor set unit shall be mounted on a concrete housekeeping pad as shown on the drawings. Concrete pads shall be provided by the HVAC Contactor. Coordinate location and dimensions of the unit and mounting elements with other trades
- B. Access – Arrange installation of units, controllers and piping assemblies to provide access space around air-handling units for service and maintenance.
- C. 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.
- D. Piping Installation
 - 1. Comply with requirements for piping specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
 - 2. Install piping adjacent to air-handling unit to allow service and maintenance.

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3. Flexible Piping Connectors – Connect piping to air-handling units mounted on vibration isolators with flexible connectors.
 4. Condensate Piping – Connect condensate drain pans using Type M copper tubing. Construct a deep trap at the connection to the drain pan and install cleanouts at changes in direction. Extend to nearest equipment or floor drain.
 5. Hot- and Chilled-Water Piping – Comply with applicable requirements in Division 23 Section "Hydronic Piping." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.
- E. Flexible Duct Connectors – Connect duct to air-handling units with flexible connections. Comply with requirements in Division 23 Section "Air Duct Accessories."

END OF SECTION 23 7313

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SECTION 23 8239 - UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cabinet unit heaters with centrifugal fans and hydronic hot-water, electric-resistance heating coils.
2. Propeller unit heaters with hydronic hot water, electric-resistance heating.
3. Wall & ceiling mounted unit heaters with propeller fans and electric-resistance heating coils.

1.2 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Equipment schedules include rated capacities, furnished specialties, and accessories.
 2. Plans, elevations, sections, physical dimensions, weight, and details.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: 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. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

PART 2 - PRODUCTS

2.1 CABINET UNIT HEATERS

- A. Fan: Direct driven centrifugal with multi-speed permanent split capacitor motor having internal overload protection.
- B. Electrical Disconnect:
 - 1. Fan speed control switch with “off” position mounted behind a hinged access door, factory wired. The “off” position shall serve as a disconnecting means for both the fan motor and the controls.
 - 2. Toggle disconnect switch furnished and mounted inside the cabinet.
- C. Heating Coil:
 - 1. Hydronic Hot Water – Seamless copper tubes with bonded aluminum fins, hydrostatically tested at 300 psi.
 - 2. Electric Resistance – Non-glowing design consisting of special high temperature resistance wire enclosed in an INCOLOY sheath to which steel fins are furnace brazed. The heating elements shall be located directly in front of the blower discharge air for uniform heating. Overcurrent protection and limits controls for high-temperature protection.
- D. Cabinet:
 - 1. Exposed units shall be constructed of galvanized steel, 16-gauge front and 20 gauge back and sides, with an outlet and inlet grille as appropriate. Recessed units shall have overlapping cabinet or wall flange on all four corners. Exposed and recessed units shall have a lockable access door.
 - a. Finish shall be baked enamel of colors selected by the Architect from the manufacturer’s standard decorator colors.
 - 2. Concealed units shall have a discharge duct collar and where return duct is required, a return duct collar.
- E. Filter: 1” pleated media throwaway, MERV 8 (Farr 30/30)
- F. Controls: Low voltage transformer, unit on-off power switch, 24V 3-way/2-way as noted position ball valve and wall mounted thermostat
- G. Manufacturers:
 - 1. Hydronic
 - a. Airtherm.
 - b. Carrier Corporation.
 - c. Dunham-Bush, Inc.
 - d. Engineered Air Ltd.
 - e. International Environmental Corporation

- f. Modine
 - g. Trane.
 - h. Zehnder Rittling
- 2. Electric-Resistance
 - a. Berko
 - b. Chromalox, Inc.
 - c. Indeeco
 - d. Markel Products
 - e. Marley Engineered Products
 - f. QMark Electric Heating
 - g. Raywall
 - h. TPI Corporation

2.2 PROPELLER UNIT HEATERS

- A. Fan: Direct driven propeller type fan with aluminum wheel and single speed permanent split capacitor motor with internal overload protection. Units shall have a wire fan guard.
- B. Electrical Disconnect:
 - 1. Toggle disconnect switch furnished and mounted on cabinet.
- C. Heating Coil:
 - 1. Hydronic – Seamless copper tubes with bonded aluminum fins, hydrostatically tested at 300 psi.
 - 2. Electric Resistance – Copper clad steel sheath element with continuously brazed steel fins formed to allow side draw through air flow. Overcurrent protection and limits controls for high-temperature protection.
- D. Cabinet: Galvanized steel, 18 gauge, with baked enamel finish. Horizontal units shall be equipped with adjustable discharge louvers.
- E. Controls: Low voltage transformer, on-off switch, 24v 2-way 2-position ball valve and unit mounted thermostat.
- F. Manufacturers:
 - 1. Hydronic
 - a. Airtherm.
 - b. Daikin Applied.
 - c. Dunham-Bush
 - d. Modine.
 - e. Trane.
 - f. Zehnder Rittling
 - 2. Electric Resistance
 - a. Berko
 - b. Chromalox, Inc.
 - c. Indeeco

- d. Markel Products
- e. Marley Engineered Products
- f. QMark Electric Heating

2.3 WALL & CEILING MOUNTED ELECTRIC RESISTANCE UNIT HEATERS

- A. Fan: Direct driven propeller fan and single speed permanent split capacitor motor with internal overload protection. Units shall have a wire fan guard.
- B. Electrical Disconnect:
 - 1. Toggle disconnect switch furnished and mounted on cabinet.
- C. Heating Element: Steel sheathed block with fin element. Overcurrent protection and high temperature protection.
- D. Cabinet: Galvanized steel, 18 gauge, with extruded aluminum frame. Unit is recessed in wall.
- E. Safety: Automatic thermal overload cut-off to deenergize the unit if an over-temperature situation occurs.
- F. Controls: Integral temperature control thermostat.
- G. Manufacturers:
 - 1. Berko
 - 2. Chromalox, Inc.
 - 3. Indeeco
 - 4. Markel Products
 - 5. Marley Engineered Products
 - 6. QMark Electric Heating
 - 7. Raywall
 - 8. TPI Corporation
 - 9. Trane.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to drawings for arrangement, type, capacity, motor characteristics and other requirements.
- B. Mounting
 - 1. Install unit heaters to comply with NFPA 90A and manufacturer's recommendations.
 - 2. Horizontal, vertical and concealed suspended unit heaters shall be suspended from all four corners, from building structure with steel hanger rods and auxiliary angles and fastening devices.
 - 3. Propeller unit heaters shall be suspended from all four corners, from building structure with steel hanger rods and auxiliary angles and fastening devices or provide ceiling or wall mounted bracket as required.

4. Wall mounted heaters that are recessed into the wall shall be provided with lintels as required by the Structural Engineer. Coordinate wall type, location and size as required.
5. Wall mounted heaters shall be provided with rough-in box and secured as required.
6. Ceiling mounted heaters shall be provided with rough-in boxes and secure as required.
7. Ceiling mounted heaters shall be suspended as required from the structure above ceiling. Coordinate with ceiling type.

C. Access

1. Install hot water piping adjacent to the machine to allow for service and maintenance.
2. Cabinet unit heaters shall be provided with lockable access covers as required for disconnecting means and service.
3. Concealed unit heaters mounted above inaccessible ceiling shall be provided with an appropriate ceiling access panel.

D. Temperature Controls

1. Wiring between the unit and wall mounted thermostats shall be run in conduit, furnished and installed by the HVAC contractor. See Section 23 0914 "Control Wiring".
2. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

E. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

END OF SECTION 23 8239

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DIVISION 26 ELECTRICAL

26 0000 General Requirements for Electrical Systems

- 26 0001 Basic Electrical Requirements
- 26 0002 Electrical Work in Existing Buildings
- 26 0003 Sleeve Installation for Electrical Penetrations
- 26 0004 Firestopping for Electrical Systems
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26 0500 Common Work Results for Electrical

- 26 0519 Low-Voltage Electrical Power Conductors and Cables
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- 26 0537 J-Hook Pathways For Electrical Systems
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26 0900 Instrumentation and Control for Electrical

- 26 0923 Lighting Control Devices
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26 2000 Low-Voltage Electrical Distribution

- 26 2213 Low-Voltage Distribution Transformers
- 26 2416 Panelboards
- 26 2726 Wiring Devices
- 26 2813 Fuses
- 26 2816 Enclosed Switches and Circuit Breakers
- 26 2913 Enclosed Motor Controllers

26 4000 Electrical Cathodic Protection

- 26 4313 Surge Protective Devices (SPD) for Low-Voltage Electrical Power Circuits

26 5000 Lighting

- 26 5113 Interior Lighting Fixtures
- 26 5600 Exterior Area Lighting

26 6000 Electronic Safety and Security

26 6102 Fire Detection and Alarm System

26 7000 Communications

26 7533 Raceway and Boxes for Communications Systems

26 7561 Voice and Data Communications Horizontal Cabling

SECTION 26 0001 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes the following:

1. General Requirements
2. Definitions
3. Scope of Work
4. Drawings and Specifications
5. Reference Standards
6. Allowances, Unit Prices and Alternates
7. Site Visit
8. Permits, Regulations and Inspections
9. Project Management and Coordination
10. Temporary Electric Services
11. Workmanship
12. Protection
13. Painting
14. Cleaning
15. Equipment Selection
16. Build America Buy America Act Requirements
17. Shop Drawings
18. Testing
19. Final Inspection and Punch List
20. Operation and Maintenance Manuals
21. Record Drawings
22. Warranties
23. Project Closeout
24. Operation and Adjustment of Equipment
25. Operating Demonstration and Instruction

1.2 GENERAL REQUIREMENTS

- A. All provisions of Division 00 Front End Documents and Division 01 General Requirements apply to work specified in this Division.
- B. Specification provisions of other relevant Divisions shall apply where applicable work is required to be performed under this Electrical work.
- C. A complete and functional Electrical system installation shall be provided under this Division. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect.

The Mechanical and Electrical drawings and specifications assign work (labor and/or materials to be provided by the General, Plumbing, Fire Suppression, HVAC or Electrical Contractor or their sub-contractors. Understanding that the contractors for mechanical and electrical work are sub-contractors to the (General) Contractor, such assignments are not intended to restrict the Contractor in assignment of work among the sub-contractor to accommodate trade agreements and practices or the normal conduct of the construction work

- D. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance Requirements.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, 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.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior 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.

1.4 SCOPE OF WORK

- A. The scope of the electrical work includes furnishing, installing, testing and warranty of all electrical work and complete electrical systems shown on the electrical drawings and specified herein, including Division 00, Division 01, Division 26 and applicable provisions of other relevant Divisions.

1.5 DRAWINGS AND SPECIFICATIONS

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word "provide", as used shall mean "furnish and install". If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect for approval before proceeding with the work.
- B. Make all necessary field measurements to insure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately

to the Architect for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having equipment, wireways and fittings fabricated and delivered in advance of making actual measurements shall not be sufficient cause to avoid making offsets and minor changes as may be necessary to install wireways, fittings and equipment.

- D. The Architect shall reserve the right to make minor adjustment in locations of system runs and components where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.
- E. Equipment, ductwork and piping shall not be installed in the dedicated electrical space above or in the working space required around electrical switchgear, motor control centers or panelboards as identified by NEC 110.26 Spaces About Electrical Equipment – 600 Volts Nominal or Less. For Equipment rated over 600 volts nominal – 110.32 Work Space About Equipment – 110.33 Entrance and Access to Work Space – 110.34 Work Space and Grounding. The Electrical Contractor shall caution other trades to comply with this stipulation.
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the Contractor causing such conflict. The Architect's decision shall be final in regard to arrangement of equipment, conduit(s), devices, wireways etc., where conflict arises.
- G. Provide offsets in system runs, additional fittings, necessary conduit, pull boxes, conductors, switches and devices required to complete the installation, or for the proper operation of the system. Each contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect. In such event, none of the trades or their suppliers shall assume that he is relieved from the work which is specified under his branch until instructions in writing are received from the Architect.

1.6 REFERENCE STANDARDS

- A. Where standards (NFPA, NEC, ASTM, UL, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the authority having jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

1.7 ALLOWANCES, UNIT PRICES AND ALTERNATES

- A. Refer to Sections 012100 Allowances, 012200 Unit Prices and 012300 Alternates.

1.8 SITE VISIT

- A. Refer to Section 017300 Execution.
- B. Each bidder shall visit the project site to understand the existing conditions and compare the conditions with information shown on the drawings. Report immediately to the Architect any issues or discrepancies which are discovered that affect the bid. Changes to contract price will not be considered for site condition issues that are readily apparent from a thorough site review.

1.9 PERMITS, REGULATIONS AND INSPECTION

- A. Work must conform to applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawing and specifications shall govern. Install no work contrary to minimum legal standards.
- B. Except where the permit application is made by the Architect or the Engineer, the Electrical contractor shall be responsible to file for and obtain all required permits from the governing inspection agencies for the Electrical work. Where the Architect or Engineer is the Architect or Engineer of record, they will furnish sealed and signed drawings and specifications required by the permit authorities except fire alarm permit documents shall be prepared and submitted by an approved, licensed fire alarm subcontractor.
- C. Include payment of all permit and inspection fees applicable to the work in this Division.
- D. All work shall be subject to inspection and approval of Federal, State and local agencies as may be appropriate as well as the Architect and Engineer.
- E. Furnish for the Owner certificates of approval from the governing inspection agencies as a condition for final payment.

1.10 PROJECT MANAGEMENT AND COORDINATION

- A. Refer to Section 013100 Project Management and Coordination.
- B. The HVAC Contractor shall initially prepare and be responsible for 1/4" scale coordination drawings. These drawings shall be reproduced and distributed to the Plumbing, Fire Suppression and Electrical Contractors for their input and revisions. Assure that all contractors work together to obtain finish coordinated drawings and no work being installed until all contractors have approved and signed-off with their approval and drawings have been submitted and reviewed by the Engineer.

1.11 TEMPORARY ELECTRIC SERVICES

- A. Refer to Section 015000 – Temporary Facilities and Controls for division of responsibilities for temporary utilities.

- B. The temporary service and temporary lighting for construction is provided by the Electrical Contractor.
- C. The Electrical Contractor is cautioned to carefully consider the possible sources of temporary electric service and the probable location of the General Contractor's office.
- D. The Electric Contractor shall furnish, install and pay for all necessary conduit, wire, metering, poles, switches, receptacles, lights and accessories to provide a 100 amp, 120/208 volt, 3 phase, 4 wire temporary electric service with the main disconnect switch and a 30 circuit load center at a location specified by the General Contractor. Serve from existing building distribution system.
- E. Labor, receptacles, boxes, fixtures, wire, etc. required by the various Contractors inside their offices shall be paid for by the respective Contractors.
- F. Lighting fixtures shall be placed every 25 ft. along each corridor or where corridors do not occur, along the long axis of all rooms. Provide a minimum 800 lumen lamp in a commercial grade molded plastic socket and lattice wire guard temporary lighting assembly with extra heavy duty "ST" 3-wire cord. Lamps shall be spaced a minimum of 10 ft. apart. For large open areas or during the early stages of construction, 250 watt metal halide fixtures (or LED equivalent) with wire guards may be utilized. Receptacle circuits shall consist of 1-gang cast "FS" type box with grounded duplex receptacles a maximum of 50 ft. on center with a maximum of 4 per circuit. All receptacle circuits shall be protected by its own overcurrent device in a panel board. Install wiring and equipment above 6'-6" and below the finished ceiling. Extend circuits as required. Provide GFCI protected receptacles and circuits as required by NEC and OSHA.
- G. Contractors requiring extension cords shall provide their own cords and plugs up to capacity of 20 amperes. For services to larger items of equipment and welders, this Contractor shall extend proper feeders as requested at the expense of the Contractors requiring the service.
- H. The Electrical Contractor shall maintain the temporary light and power system for the duration of the work and shall remove it from the site when directed. Temporary wiring and equipment shall remain the property of the Electrical Contractor.
- I. The use of the permanent electrical system for temporary services during the latter stages of construction shall be allowed. Expedite completion of system as practicable to this end. Maintain the system during this period.
- J. Warranty periods on equipment, materials and systems shall commence upon Owner acceptance of the building or systems. Temporary use shall not jeopardize or alter warranty requirements.
- K. The complete temporary service shall comply with OSHA, and all Code requirements.

1.12 WORKMANSHIP

- A. Refer to Section 01400 Quality Requirements.
- B. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all

respects, and the Architect shall have the right to stop the work if highest quality workmanship is not maintained.

- C. Electrical work shall be performed by a licensed Electrical Contractor in accordance with requirements of the jurisdiction.

1.13 PROTECTION

- A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect.
- B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide plastic sheeting, drop cloths or similar barriers where dust and debris is generated, to protect adjacent areas.
- C. Contractor shall protect all equipment and materials from detrimental effects of weather or construction activity. All items shall be stored and secured in a protected location away from the daily work area. Equipment or materials shall be placed on raised skids to protect from surface moisture. Where appropriate, provide plastic sheeting or similar vapor barrier underneath the stored products to reduce the effects of ground moisture or curing concrete on the local humidity levels. Where unfinished ferrous products or finished ferrous products with raw edges are stored, provide local, dry heat to maintain ambient relative humidity levels below 65% RH to prevent rust.
- D. All equipment shall retain the original packaging until required to be removed for installation or operation. Open ends of ducts, piping, conduit, etc. shall be capped or sealed and ventilation openings into equipment shall be wrapped and sealed in plastic sheeting to prevent dust or dirt entry both when stored and after installation but still open to the effects of construction activity. Stored items as well as installed equipment shall be covered with plastic sheeting at all times until placed in service or until dust generating activity in the area has ceased.

1.14 PAINTING

- A. In addition to any painting specified for various individual items of equipment, the following painting shall be included in the Electrical Contract:
 - 1. All metal which is not factory or shop painted and which remains exposed to view in the building including finished areas, mechanical rooms, storage rooms and other unfinished areas shall be given a prime coat of paint.
 - 2. All metal installed outside the building which is not factory or shop painted shall be given a prime coat of paint.
 - 3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch-up.
 - 4. Apply Z.R.C. Cold Galvanizing Compound, or approved equal, for touch-up of previously galvanized surfaces.

5. Paint, surface preparation and application shall conform to applicable portions of the Painting section of Division 09 Finishes. All rust must be removed before application of paint.

- B. Finish painting is included in the General Contract. Refer to the Cutting and Patching paragraph in this Section for finishing requirements.

1.15 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.
- C. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain.
- D. Before placing each system in operation, the equipment shall be thoroughly cleaned; cleaning shall be in accordance with equipment manufacturer's recommendations.
- E. Refer to appropriate Sections for cleaning of other equipment and systems for normal operation.

1.16 EQUIPMENT SELECTION

- A. Materials and equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.
- B. All electrical equipment and wiring shall bear the Underwriters Laboratories, Inc. label where UL label items are available, and shall comply with NEC (NFPA-70) and NFPA requirements.
- C. The selection of materials and equipment to be furnished under this contract shall be governed by the following:
 1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specification, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturers listed.
 2. Where the words "or approved equal" appear after a manufacturer's name, specific written approval must be obtained from the Engineer during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
 3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval during shop drawing submittal.

- D. Substitute equipment of equal quality and capacity will be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.
- E. Before bidding equipment, and again in the preparation of shop drawings, the Contractor and his supplier shall verify that adequate space is available for entry and installation of the item of equipment, including associated accessories. Also verify that adequate space is available for servicing of the equipment and that required NEC (and other applicable Code's) clearances are met. The Contractor and his supplier shall also verify compatibility of equipment specified with available system/service voltages, etc.
- F. If extensive changes in conduit, equipment layout or electrical wiring and equipment are brought about by the use of equipment or existing site conditions which are not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in the contract.

1.17 BUILD AMERICA, BUY AMERICA ACT REQUIREMENTS

- A. This project will receive Federal funding. Therefore, products and materials procured for the project must comply with the Build America, Buy America act (BABA). Refer to the City of Dayton General Provisions and Supplemental Specifications for compliance requirements.
- B. The Contractor must maintain a complete list of construction materials, products, and manufacturers' certifications for products used in the project in order to verify (BABA) compliance.

1.18 SHOP DRAWINGS

- A. Refer to Section 016000 Product Requirements.
- B. One set of shop drawings, in electronic format (pdf), with descriptive information shall be assembled by each Contractor of equipment and materials furnished in his contract, and submitted to the Architect and/or Engineer for review as stated in Division 01. These shall be submitted as soon as practicable and before special equipment is manufactured and before installation.
- C. Shop drawings for equipment fixtures, devices and materials shall be labeled and identified same as on the Contract Documents. Failure to do so may be cause for rejection of shop drawings.
- D. The review of shop drawings by the Architect or Engineer shall not relieve the Electrical Contractor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.
- E. Shop drawings of the following electrical equipment and materials shall be submitted:
 - 1. Firestopping.
 - 2. Wireway.

3. Cable trays.
4. Miscellaneous cabinets.
5. Plenum cable.
6. Medium voltage switchgear and unit substations.
7. Loop thru and tap switch.
8. Medium voltage cable and terminations.
9. Wiring devices and coverplates.
10. Service/Distribution switchboard.
11. Dry type transformer – secondary.
12. Panelboards and associated distribution equipment.
13. Fuses.
14. Motor controllers (VFD's) and disconnects.
15. Lighting Controls including layout plans of Occupancy Sensors.
16. Low voltage switching/lighting control system
17. Lighting fixtures and lamps.
18. Lighting standards.
19. Automatic transfer switches.
20. Emergency generator and accessories.
21. Lightning protection system.
22. Access control and video surveillance system with wiring diagrams.
23. Fire alarm system with schematic and point to point wiring diagrams.

1.19 TESTING

- A. As each wiring system is completed, it shall be tested for continuity and freedom from grounds.
- B. As each electrically operated system is energized, it shall be tested for function.
- C. The Contractor shall perform megger and resistance tests and special tests on any circuits or equipment when an authorized inspection agency suspects the system's integrity or when requested by the Architect or Engineer.
- D. All signaling and communications systems shall be inspected and tested by a qualified representative of the manufacturer or equipment vendor. Submit four (4) copies of reports indicating results.
- E. Tests shall be witnessed by field representatives of the Architect or Engineer or shall be monitored by a recorder when appropriate. Furnish a written record of each system test indicating date, system, test conditions, duration and results of tests.
- F. Instruments required for tests shall be furnished by the Contractor.

1.20 FINAL INSPECTION AND PUNCH LIST

- A. Refer to Section 017700 Closeout Procedures.
- B. As the time of work completion approached, the Contractor shall survey and inspect his work and develop his own punch list to confirm it is complete and finished. He shall then notify the Architect and request that a final inspection be made. It shall not be considered the Architect's

or Engineer's obligation to perform a final inspection until the Contractor has inspected the work and so states at the time of the request for the final inspection.

- C. Requests to the Architect, Engineer or Owner for final inspection may be accompanied by a limited list of known deficiencies in completion, with appropriate explanation and schedule for completing these; this is in the interest of expediting acceptance for beneficial occupancy.
- D. The Architect and/or Engineer will inspect the work and prepare a punch list of items requiring correction, completion or verification. Corrective action shall be taken by the Contractor to the satisfaction of Architect and Engineer within 30 days of receipt of the Architect/Engineer's punch list.

1.21 OPERATING AND MAINTENANCE MANUALS

- A. Refer to Section 017823 Operation and Maintenance Data.
- B. Digital copy (pdf) of operating and maintenance manuals shall be assembled for the Electrical work by the Contractor and provided on a flash drive.
- C. All shop drawings and installation, maintenance and operating instruction pamphlets or brochures, wiring diagrams and other information, along with warranties, shall be obtained from each manufacturer of the principal items of equipment. In addition, the Contractor shall prepare a chart listing all items of equipment which are furnished under his contract and indicating the nature of maintenance required, the recommended frequency of checking these points and the type of replacement material required. Major items of equipment shall consist of not less than the following:
 - 1. Panelboards and Distribution switchgear.
 - 2. Motor controllers.
 - 3. Fire Alarm System.
 - 4. Specialty equipment.
- D. Standard NEMA publications on the operation and care of equipment may be furnished in lieu of manufacturer's data where the manufacturer's instruction is not available.
- E. These shall be combined into a single electronic file in .PDF format. An index and tabbed sheets to separate the sections shall be included. These shall be submitted to the Architect or Engineer for review. Upon approval, manuals shall be turned over to the Owner.

1.22 RECORD DRAWINGS

- A. Refer to Section 017839 Project Record Drawings.
- B. The Electrical Contractor shall maintain a separate set of prints of the contract documents and shall show all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work, these drawings shall be turned over to the Architect. This shall apply particularly to underground and concealed work, and to other systems where the installation varies to a degree which would justify recording the change.

1.23 WARRANTIES

- A. Refer to Section 017700 Closeout Procedures.
- B. This Contractor shall warrant all workmanship, equipment and material entering into this contract for a period of one (1) year minimum from date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect. Any materials or equipment proving to be defective during this warranty period shall be made good by this Contractor without expense to the Owner.
- C. This provision is intended specifically to cover deficiencies in contract completion or performance which are not immediately discovered after systems and placed in operation. These items include, but are not limited to, motor controller malfunction, heater element changes required for motor controller, fuse replacement where fuses blow due to abnormal shorts, adjustments and/or replacement of malfunctioning equipment and adjusting special equipment and communication systems to obtain optimum performance.
- D. This provision shall not be construed to include maintenance items such as making normally anticipated adjustments or correcting adjustment errors on the part of the Owner's personnel.
- E. Provisions of this warranty shall be considered supplementary to warranty provisions under General Conditions.
- F. Extended warranties shall be provided where indicated in the equipment specification Sections.

1.24 PROJECT CLOSE-OUT

- A. Refer to Section 017700 Closeout Procedures
- B. The following schedule summarizes actions to be taken or submittals to be completed by Contractor prior to issuance of the Contract Completion Certificates. Refer to Division 1 – General Requirements and applicable paragraphs of this Section and the applicable trade Divisions for additional requirements. This information should be submitted at least thirty days in advance of request for final inspection. Where possible, the information shall be bound in 8.5" x 11.0" hard back binders.
 - 1. Materials/Suppliers List
 - 2. Record Drawings
 - 3. Certificate of Inspection
 - 4. Electrical Tests and Adjustments
 - 5. Operating Instructions and Maintenance Manuals
 - 6. Identification Nameplates
 - 7. Color Coding of Conduits
 - 8. Manufacturer's Certification of Installation:
 - a. Fire Alarm System
 - 9. Receipt for Keys:
 - a. Distribution Switchboards
 - b. Panelboards
 - 10. Complete Punch List
 - 11. Waiver of Liens

12. Affidavit of Wage Compliance
13. Change Orders and Allowance Adjustment

1.25 OPERATION AND ADJUSTMENT OF EQUIPMENT

- A. As each system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing and adjusting voltages and currents and adjusting all operating equipment.
- B. Caution: Verify that all bearings of equipment furnished are lubricated, all motors are operating in the right direction, and correct overload heater elements are provided on all motors. Do not depend wholly on the other trades judgment in these matters. Follow specific instructions in regard to lubrication of equipment furnished under this Contract.

1.26 OPERATING DEMONSTRATION AND INSTRUCTIONS

- A. Refer to Section 017900 Demonstration and Training as well as individual Division 26 Sections for requirements.
- B. The Contractor shall set the various systems into operation and demonstrate to the Owner and Architect that the systems function properly and that the requirements of the Contract are fulfilled.
- C. The Contractor shall provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.
- D. A minimum of 8 hours shall be allowed for instructions to personnel selected by the Owner. Instructions shall include not less than the following:
 1. Show locations of items of equipment and their purpose.
 2. Review binder containing instructions and equipment and systems data.
 3. Coordinate written and verbal instructions so that personnel understand each.
 4. Separate instructions shall be given by manufacturer's representatives for the various special and communications systems.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION – NOT APPLICABLE

END OF SECTION 26 0001

SECTION 26 0002 – ELECTRICAL WORK IN EXISTING BUILDINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes the following:

1. General Requirements for Renovation Work
2. Inspection of Existing Building
3. Asbestos Material
4. Work Hours
5. Tobacco Products
6. Barriers and Signage
7. Storage of Tools and Materials
8. Protection of Existing Building and Equipment
9. Confined Spaces
10. Noise, Fumes and Dust Control
11. Removals Disposal and Reuse
12. Continuity of Systems
13. Cutting and Patching
14. Cleaning

1.2 GENERAL REQUIREMENTS FOR RENOVATION WORK

- A. Refer to Article 1 Specification requirements and notes on the drawings where provided for requirements related to renovation work.
- B. Meet with the Owner and Architect before demolition or construction begins to establish procedures for work effort in the existing building. Provide names and phone numbers and establish emergency contact information where work is performed. Provide security information requested by the Owner for all personnel who will be working on site. Educate all construction personnel in regard to the project requirements and procedures.
- C. Coordinate effort with other contractors involved in the renovation project to minimize the disruption, phasing of work, share cleaning responsibilities, etc.

1.3 INSPECTION OF EXISTING BUILDING

- A. Each bidder shall inspect the project site and the existing building in the early time frame of the bidding period. Conditions shall be compared with information shown on the drawings. Report to the Architect any significant discrepancies which may be discovered in a timely fashion so

that direction may be provided in an addendum. After the contract is signed, no allowance will be made for failure to have made a thorough inspection.

1.4 ASBESTOS MATERIAL

- A. Abatement, removal or encapsulation of existing materials containing asbestos is not included in the Contract. Necessary work of this nature will be arranged by the Owner to be done outside of this construction and remodeling project by a company regularly engaged in asbestos abatement. Such work will be scheduled and performed in advance of work in the construction and remodeling project.
- B. If, in the performance of the mechanical work, materials are observed which are suspected to contain asbestos, the Contractor shall immediately inform the Architect who in turn will notify the Owner. Work that would expose workers to the inhalation of asbestos particles shall be terminated. Work may be resumed only after a determination has been made and unsafe materials have been removed or encapsulated and the area declared safe.

1.5 WORK HOURS

- A. Work hours for construction shall be as defined in Section 01150- Project Phasing or other specification sections or drawing notes.
- B. Where allowed, contractors may work normal hours except after hours is required for operations that are noisy, generate obnoxious fumes or dust, require shut down of ventilation systems, etc. The Owner reserves the right to stop normal hour work where the Owner deems the effort to be disruptive to their ongoing operations.
- C. Any work that creates hazards in or requires closure of corridors, exit pathways or stairwells work in corridors must be performed after hours when the building is not occupied.
- D. All occupied areas, corridors exit pathways and stairwells must be left clean, lighted (including emergency egress and exit signage) usable and safe at the end of each work shift.
- E. Access to the work area shall be coordinated with the Owner; follow all security protocols for parking, sign in, key control, etc. established by the Owner.

1.6 TOBACCO PRODUCTS

- A. Smoking or chewing tobacco products are expressly prohibited to be used within the building and on the premises except where specifically permitted by the Owner or in construction company trailers or vehicles where permitted by the construction company.

1.7 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build

America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS- NOT APPLICABLE

PART 3 - EXECUTION

3.1 BARRIERS AND SIGNAGE

- A. Barriers and signage shall be provided as appropriate to identify work areas and to prevent unauthorized entry by non construction personnel. Refer to appropriate Division 1 specification requirements and notes on the drawings where provided.
- B. All barriers and signs should be high visibility type and be maintained at all times.

3.2 STORAGE OF TOOLS AND MATERIALS

- A. Store all site material and tools in the active job site area, specific storage areas are not provided except where otherwise noted for material and tools. The contractor is responsible for security.
- B. Storage is specifically prohibited in means of egress paths and stairwells.

3.3 PROTECTION OF EXISTING BUILDING AND EQUIPMENT

- A. The Owners' property and the property of other contractors shall be respected at all times. Provide drop clothes, visqueen or other suitable barriers where dust and debris is generated. Tape ends of barriers for sealing purposes.
- B. Provide 55 gallon drums or smaller buckets as appropriate and use funnels where draining liquid systems.
- C. Provide plywood sheets for protection of walls, floors or Owner equipment or systems that are remaining in place near demolition or new installation work where there is possible damage from heavy material or equipment.

3.4 CONFINED SPACES

- A. Notify the Owner when performing work in confined spaces. Provide a written procedure for approval and obtain approval from the Owner when so requested.
- B. All work in confined spaces shall be done in accordance with OSHA regulations.

3.5 NOISE FUME AND DUST CONTROL

- A. Provide barriers and ventilation as required to limit the effect from construction generated noise fume and dust control on spaces that continue to be occupied by the Owner. Refer to protection of building and equipment paragraph above. In addition to the basic protection, provide additional visqueen barriers to limit airborne migration of dust and fumes. Provide supplemental portable fans to exhaust air to the outside of the building where appropriate. Use of the Owners' ventilation systems to induce positive or negative pressure is prohibited unless authorized by the Owner. Shut off ventilation systems serving the area where use of these systems can induce fumes or dust into return or exhaust ducts. Where systems need to remain operational for occupied areas, arrange to temporarily shutoff portions of the system in the work area. Coordinate all efforts requiring modification or shutdown of ventilation systems with the Owner. Contractor shut down of these systems is prohibited without Owner permission.
- B. Arrange with the Owner when required to shutoff fire alarm or smoke detectors to perform work. With the Owners' prior approval. Cover smoke detectors where needed to prevent false alarms due to generated dust or fumes. Minimize outages and coordinate efforts to limit the effect due to false alarms.
- C. Where significant dust or fume generating work, welding or cutting operations are required for removal or new work, provide fume removal equipment with telescoping arms to locally capture the fumes. Fume exhaust shall be directed outside or adequately filtered and recirculated.
- D. Areas shall be thoroughly ventilated after completion of the work on a daily basis to remove residual odors and fumes before occupancy occurs the next day.
- E. Provide vacuum cleaners and other equipment to clean and restore conditions.

3.6 REMOVALS DISPOSAL AND REUSE

- A. Refer to the drawings for the scope of remodeling in the existing building.
- B. Cooperate with the General Contractor regarding all removal and remodeling work. Each Contractor shall remove existing work which is associated with his trade and which will be superfluous when the new work is installed and made operational.
- C. Extraneous conduit and wiring which is or becomes accessible shall be removed back to source or last active device. Conduit and wiring that is and remains inaccessible shall be abandoned. Upon completion of the work no abandoned boxes, conduits or wiring shall extend thru finished floors, walls or ceilings.
- D. When it is necessary to reroute a section of active circuitry the rerouted section shall be installed before removing the existing in order to minimize system down time.
- E. Where existing equipment, boxes, conduits etc. are removed and holes are left in existing walls, finished ceilings, floors etc. these holes shall be patched using materials to match the existing construction to restore and maintain the integrity of the existing partition.

- F. Materials and equipment which are removed shall not be reused within the scope of this project unless specifically noted to be relocated or reused. Turn over to the Owner and place where directed on the premises all removed material and equipment so designated by the Owner. All material and equipment which the Owner does not wish to retain shall become the property of the Contractor responsible for removal and shall be removed from the premises and properly disposed.
- G. Disposal of materials regulated by EPA, including lamps and ballasts shall be done in strict accordance with latest requirements. Provide documentation to the Owner that disposal was properly executed.
- H. Remove, store and reinstall lay-in ceiling tile and grid as needed to perform work in areas where such removal and re-installation is not to be done by the General Contractor. Damaged tile and/or grid shall be replaced with new matching tile and/or grid.
- I. In areas of minor work where the space is not completely vacated, temporarily move portable equipment and furnishings within the space as required to complete the work. Coordinate this activity with Owner. Protect the Owner's property by providing dust covers and temporary plastic film barriers to contain dust. Remove barriers and return equipment and furniture upon completion of the work.
- J. Refinish any surface disturbed under this work to match existing, except where refinishing of that surface is included under the General Contract.
- K. The removal of fire alarm devices, if those devices are not to be reused, shall include all programming changes need at the fire alarm head end panel.

3.7 CONTINUITY OF SYSTEMS

- A. Work shall be so planned and executed as to provide reasonably continuous services of existing systems throughout the construction period. Where necessary to disrupt services for short periods of time for connection, alteration or switch-over, the Owner shall be notified in advance and outages scheduled at the Owner's reasonable convenience.
- B. Submit, on request, a written step-by-step sequence of operations proposed to accomplish the work. The outline must include tentative dates, times of day for disruption, downtime and restoration services. Submit the outline sufficiently in advance of the proposed work to allow the Architect to review the information with the Owner. Upon approval, final planning and the work shall be done in close coordination with the Owner.
- C. Shutdown of electrical power system and work undertaken during shutdowns shall be bid as being done outside of normal working hours on a premium time basis..

3.8 CUTTING AND PATCHING

- A. Refer to Division 1 – General Requirements for information regarding cutting and patching.

- B. Plan the work well ahead of the general construction. Where conduits are to pass thru new walls, partitions, floors, roof or ceilings, place sleeves in these elements or arrange with the General Contractor to provide openings where sleeves are not practical. Where sleeves or openings have not been installed, cut holes and patch as required for the installation of this work, or pay other trades for doing this work when so directed by the Architect. Any damage caused to the building shall be repaired or rectified.
- C. Where conduits are to pass thru, above or behind existing walls, partitions, floors, roof or ceiling, cutting, patching and refinishing of same shall be included in this contract. Core drilling and saw cutting shall be utilized.
- D. All material, methods and procedures used in patching and refinishing shall be in accordance with applicable provisions of specifications governing the various trades. The final appearance and integrity of the patched and refinished areas must meet the approval of the Architect. Wall, floor and ceiling refinishing must extend to logical termination lines (entire ceiling of the room repainted, for instance), if an acceptable appearance cannot be attained by finishing a partial area.
- E. Provide steel angle or channel lintels to span openings which are cut in existing jointed masonry wall where the opening span exceeds 16 inches. Provide framing around roof openings for required support of the roof deck.

3.9 CLEANING

- A. Debris, dust, dirt, etc shall be removed daily, particular attention shall be paid to areas that the Owner is continuing to occupy or use; any mess created in corridors, stairwells and egress paths that are maintained during construction shall be cleaned immediately.
- B. The Owners dumpsters and trash receptacles shall not be used. If a dumpster is required, it shall be provided by the contractor and located where approved by the Owner. Coordinate dumpster requirements with other contractors.
- C. Before turning an area back over to the Owner, thoroughly clean the space to leave the area in a similar condition before the start of the project where finishes are to remain.

END OF SECTION 26 0002

SECTION 26 0003 – SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

1.1 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Floor sleeves shall be flush with the bottom and top of the floor slab except, in mechanical rooms and other areas which might have water on the floor, sleeves shall project a minimum of 1" above finished floor.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants".
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

1.2 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use 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.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Stainless steel. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

1.3 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

END OF SECTION 26 0000

SECTION 26 0004 – FIRESTOPPING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.2 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Firestopping assemblies shall be tested and rated in accordance with ASTM E814 (ANSI/UL 1479) Fire Tests of Through-Penetration Fire Stops (minimum positive pressure of .01 inches of water column) and E119 (ANSI/UL 263) Fire Tests of Building Construction and Materials Time-Temperature Curve. Firestopping shall provide an “F” fire rating equal to that of the construction being penetrated. Firestop systems shall meet all requirements of the Ohio Building Code.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - 2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view or above ceilings in air return plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of

construction condition penetrated, relationships to adjoining construction, and type of penetrating item.

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Firestopping materials shall be manufactured and/or supplied by:

1. Hilti, Inc.
2. Johns Manville.
3. Nelson Firestop Products.
4. Specified Technologies Inc.
5. 3M; Fire Protection Products Division.
6. Tremco; Sealant/Weatherproofing Division.

2.2 FIRESTOPPING

- A. Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. These shall be installed in conjunction with sleeves and materials for fill and damming.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.
- B. Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.
- C. Provide firestop system for every conduit or opening at penetration of all fire resistance rated walls and horizontal assemblies.
- D. Provide rigid supports for conduit on both sides of the fire resistance rated wall or assembly where required as part of the fire stop assembly.
- E. Coordinate opening size and additional framing requirement with the General Contractor for each opening to meet the firestop installation requirements.
- F. Refer to 26 0533 Raceway and Boxes for Electrical Systems for sleeve requirements and treatment of penetrations not requiring firestopping.

- G. Annular space of penetrations of nonfire-resistant-rated floor, floor/ceiling assemblies, or the ceiling membrane of a nonfire-resistant rated roof/ceiling assembly shall be filled with an approved firestopping material to resist the free passage of flame and products of combustion.
- H. Smoke Barriers:
 - 1. Penetrations shall be sealed with a firestopping system to prevent the passage of smoke.
- I. Smoke Partitions:
 - 1. Penetrations shall be sealed with a caulking material to prevent the passage of smoke.
Non-rated smoke partitions do not require a fire stopping system.

END OF SECTION 26 0004

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SECTION 26 0005 – EXCAVATION, BACKFILL AND SURFACE RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Excavating and backfilling for all in-grade underfloor conduit, exterior ducts, conductors, conduit, lighting standard bases, handholes, pullboxes, utility trenches and any incidental work included in the Electrical Contract.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over conduit or duct in a trench, including haunches to support sides of conduit.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Course placed over the excavated sub-grade in a trench before laying manhole, pullbox or conduit.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. 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 Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

E. Fill: Soil materials used to raise existing grades.

F. 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.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below topsoil materials.

H. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

1.4 GENERAL

- A. Excavate for all in-grade underfloor conduit, exterior ducts, conductors, conduit, lighting standard bases, manholes, handholes, pullboxes, utility trenches and any incidental work included in the Electrical Contract.. Backfill to finish grade or to levels consistent with the General Contractor's and Site Contractor's activities. Cut existing street, drive and parking lot paving, walks, curbs and other permanent hard surfaces which are to be encountered. Repair or restore exterior surfaces to original condition where such are not affected by Division 2 – Site Work. Cut existing floor slabs and replace slabs in conformance to 26 002 Basic Electrical Materials and Methods. All work shall comply with requirements set forth in Division 2.
- B. Excavation and trench wall supporting, cribbing, sloping and stepping of excavations required for safety shall be done in accordance with OSHA and local requirements. Pumping of water from excavations and trenches which may be required during construction shall be included in this contract.
- C. Contact the Ohio Utilities Protection Service (1-800-362-2764) well in advance of the start of any excavation to determine if any of the utility companies or departments have underground utilities in or near the project area.
- D. Contact local water and sewer departments, gas company, electric company, telephone company, etc., regarding the possibility of encountering existing utilities. The integrity of all existing utilities shall be respected.
- E. Existing utilities encountered during excavation work shall be protected in a manner acceptable to the utility owner. Any utilities that are damaged shall be repaired or replaced by the Contractor to the full satisfaction of the utility owner.

- 1.5 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

- 2.1 Refer to Division 31 Earthwork for bedding and backfill materials

PART 3 - EXECUTION

3.1 EXCAVATION FOR UTILITY TRENCHES

- A. Interior and exterior trenches shall be over-excavated and the conduits, ducts or conductors shall be laid on 6" minimum depth sand bed.
- B. Backfilling of excavations and trenches inside the building and outside under paved or other hard surfaced areas, shall be with graded pea gravel, graded coarse sand or crushed limestone, 3/4" maximum size, to prevent undue settlement. Backfill material for plastic piping shall be pea gravel or sand. Other excavations and trenches shall be backfilled with similar materials up to 18" above the top of the conduit or conductor. The remainder shall be with similar materials or with excavated material having no large clods, stones or rocks.
- C. Maintain in place adequate barricades, guards, planking, plating signage, warning lights, etc., at and around excavations.
- D. Backfill shall be mechanically compacted in layers not over 6" deep. Water settling will not be permitted. Where excavations have not been properly filled or where settlement occurs, they shall be refilled, compacted, smoothed off, and finally made to conform to the initial requirements. Excess excavated materials shall be removed from the site or disposed of as directed by the General Contractor. Refer to Division 31 Earthwork for compaction requirements.
- E. Concrete floor slabs, paving, sidewalks, curbs sodded and other finished surfaces which have been damaged or removed in order to install the underground work shall be replaced but this Contractor equal to original conditions. Refer to Division 32 for Surface Restoration requirements. This requirement is not applicable in areas where the General Contractor or the Site Contractor is obligated to provide new surfaces.
- F. Excavation, backfill, surface repair and traffic control within the public right-of-way shall be in accordance with governing agency rules and regulations. Any fee for activity in the roadways shall be included in this contract so that no additional cost will accrue to the Owner.
- G. All exterior underground direct buried conduit shall be protected against future excavation damage by placing a plastic tape warning marker in each trench during backfill. Tape shall be 6" wide with black letters identifying the type of service. Tape shall be equal to that manufactured by Seton. Install tape full length of the trench approximately 18' above and on the centerline of the conductor, conduit or duct.

END OF SECTION 26 0005

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 VAC and less.
 - 2. Connectors, splices, and terminations rated 600 VAC and less.
 - 3. Photovoltaic wires and cables rated for 1500 VDC or less.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: 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 NFPA 70.

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70.
- B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and XHHW.
- C. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC and metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

- A. 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
- C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR SIZE

- A. Refer to schedule on drawings.

3.2 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Stranded for No. 8 AWG and larger.

3.3 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- C. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- D. Class 2 Control Circuits: Power-limited cable, in raceway.
- E. Use conductors such as type FEP with high temperature insulation as identified in the NEC for connections to resistance heating elements or in other areas subject to temperature exceeding the rating of THWN, XHHW or THHN.
- F. In addition to the conduit system, a separate grounding conductor shall be installed with all feeders and branch circuitry.
- G. Equipment grounding conductors shall be green, or completely taped green, at all accessible points.

- H. Wire size ampacity shall equal or exceed its overload protective device. Where sizes shown on the drawings are greater than the apparent ampacity requirements, the size shown shall prevail to compensate for voltage drop. In no instance shall conductors be installed that are less than required by the N.E.C. Minimum conductor size shall be No. 12 AWG except No. 14 AWG may be used for control wiring or where otherwise specifically indicated.

3.4 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. 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.
- C. Conduit systems shall be clean and clear before pulling wires. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway. Pulling of branch circuit conductors shall be performed by manual means without the use of levers or heavy pulling devices that may compromise the conductor's or insulation integrity.
- D. A maximum of 8 conductors shall be installed in a branch circuit conduit unless specifically noted otherwise on the drawings. Equipment ground conductors are not counted when determining maximum fill.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Wiring in vertical raceways shall be supported with strain relief devices; Kellems grips or approved equal.
- G. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."
- H. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- I. 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 and UL 486B.
- J. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- K. Underground splices (including splices in exterior pullboxes and manholes) shall be made using sealing kits or wire nuts U.L. listed and approved for the application.
- L. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack. Refer to additional notes on plans for branch circuitry installation requirements.

3.5 TESTING

- A. As each wiring system is completed, it shall be tested for continuity and freedom from grounds.
- B. As each electrically operated system is energized, it shall be tested for function.
- C. On all electric services including change-outs, backfeeds, etc. the Contractor shall verify phase rotation and voltage readings to assure the final installation is proper. Submit to the Engineer in writing a record of voltage readings and current readings taken at no-load and fully loaded conditions.
- D. The Contractor shall perform megger and resistance tests and special tests on any circuits or equipment when an authorized inspection agency suspects the system's integrity or when requested by the Engineer.
- E. Tests shall be witnessed by field representatives of the Engineer or shall be monitored by a recorder. Furnish a written record of each system test indicating date, system, test conditions, duration and results of tests. Copies of all test reports shall be included in the O&M manuals.
- F. Instruments required for tests shall be furnished by the Contractor.

END OF SECTION 26 0519

SECTION 26 0523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. UTP cabling.
2. RS-232 cabling.
3. RS-485 cabling.
4. Low-voltage control cabling.
5. Control-circuit conductors.
6. Identification products.

1.2 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- B. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.
- C. Maintenance data.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of an NRTL.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: **25** or less.
 2. Smoke-Developed Index: **50** or less.
- 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.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
- B. Test each pair of UTP cable for open and short circuits.

1.6 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Support of Open Cabling: NRTL labeled for support of **Category 6** cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.
- B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
 - 1. Outlet boxes shall be no smaller than 2 inches wide, 4 inches high, and 2-1/2 inches deep.

2.2 BACKBOARDS

- A. Description: Plywood, **fire-retardant treated**, 3/4 by 48 by 96 inches. Prime and finish paint to match adjacent walls (if finish painted) or finish paint white or light gray.

2.3 RS-232 CABLE

- 1. \
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
 - 1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - 2. Plastic insulation.
 - 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - 4. Plastic jacket.
 - 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
 - 6. Flame Resistance: Comply with NFPA 262.

2.4 RS-485 CABLE

A. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.5 LOW-VOLTAGE CONTROL CABLE

A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.6 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway or power-limited cable, concealed in building finishes, complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

2.7 IDENTIFICATION PRODUCTS

- 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. HellermannTyton.
 3. Kroy LLC.
 4. Panduit Corp.
- B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

- A. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- B. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 4. Cables may not be spliced.
- C. Installation of Control-Circuit Conductors:
 - 1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- D. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - 2. Suspend copper cable 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.
- E. Separation from EMI Sources:
 - 1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

3.3 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
 - 1. Class 1 remote-control and signal circuits, **No 14 AWG**.

2. Class 2 low-energy, remote-control, and signal circuits, **No. 16** AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits, **No 12** AWG.

3.4 FIRESTOPPING

- A. Comply with requirements in Section 26 0004 "Firestopping for Electrical Systems."

3.5 GROUNDING

- A. For data communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Visually inspect UTP cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 3. Test UTP 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 after cross connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.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.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 26 0523

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: 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 UL 467 for grounding and bonding materials and equipment.

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 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 in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 GROUNDING RODS

- A. Grounding Rods shall be copper clad, molten welded copper to steel; unless otherwise designated, ¾" diameter X 10 ft. long.

2.3 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory 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, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Clamps and continuity devices shall be non-ferrous material, UL approved. Connections to ground rods and all underground connections shall be made with welded connections ("Thermoweld" or "Cadweld").

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 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. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. 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. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels.
- B. Wiring devices shall be connected with grounding jumper from ground pole on device to grounding screw (or grounding pigtail) in the outlet box.
- C. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 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. 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 so vibration is not transmitted to rigidly mounted equipment.
- C. Main service neutral shall be grounded to the street side of the building water service. A bonding jumper shall be installed around the water meter. In addition to using the water service as a grounding electrode, effectively grounded building steel, driven ground rods outside or buried electrode shall be provided and connected. Bond to interior metallic water, gas and all other metallic lines.
- D. The complete metal conduit system shall be used for the equipment grounding system. Conduit systems and associated fittings and terminations shall be made mechanically tight to provide a continuous electrical path to ground and shall be safely grounded at all equipment by bonding all metallic conduit to the equipment enclosures with locknuts cutting thru paint of enclosures. Bond all conduits entering service entrance switchboard with a ground wire connecting the grounding bushings to the equipment ground bar. Conductors shall be sized per NEC Tables 250-66 and 250-122. Bond all communications conduit systems to ground.
- E. In addition to using the conduit system for grounding, a complete auxiliary green wire equipment grounding system shall be installed, continuous from main ground, thru distribution and branch circuit panelboards and paralleling all feeders and branch circuit wiring. Grounding

conductor sizes shall comply with NEC Table 250-122, minimum size shall be #12 copper except #14 on control circuits. This shall apply to all circuits rated 100 volts or more above ground potential.

- F. Ground neutral of all transformers for separately derived systems.
- G. Motor frames shall be bonded to the equipment grounding system by an independent green wire, sized as shown.
- H. Cord connected appliance frames shall be grounded to the equipment grounding system thru a green wire in the cord.
- I. A green grounding conductor shall be installed in each non-metallic conduit and all flexible conduits, including exterior underground conduits.
- J. System neutral connections shall be insulated from metal enclosures except at the neutral of the service entrance equipment and on the neutral of a separately derived system. Connections to the main service enclosure shall be by means of bonding jumpers.
- K. The building neutral shall be identified throughout with white conductors for 280/120 volt systems and grey conductors for 480/277 volt systems. Where there are neutral conductors from a separately derived system (such as 120/208 volt, 3 phase, 4 wire where the main building service is 277/480 volt, 3 phase, 4 wire) the neutrals of the two systems shall be separately identifiable per NEC Article 200.
- L. A minimum #6 ground wire shall be run from each telephone backboard/data rack back to the main building ground. Or where indicated on the drawings or in the specifications, a separate communications grounding system shall be provided and bonded to the electrical grounding system at the main ground bar.
- M. Where metal covers on pull boxes and junction boxes are used, they shall comply with the grounding and bonding requirements of NEC Article 250.
- N. Connections to driven ground rods or other such electrodes shall be a minimum of 3 feet from the building foundation wall or beyond the roof drip line, whichever is greater.

END OF SECTION 26 0526

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Hangers and supports for electrical equipment and systems.

1.2 PERFORMANCE REQUIREMENTS

- A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

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. 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. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. Thomas & Betts Corporation.
 - e. Unistrut; Tyco International, Ltd.
 - f. 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.

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4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 5. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. 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.
- D. 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.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. 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. 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:
 - 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; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 5. Toggle Bolts: All-steel springhead type.
 6. Hanger Rods: Threaded steel.

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 in diameter.
- C. Utilize supports with swivel type attachments to maintain true vertical support from sloped structure or inclined structural elements (such as beam clamp with swivel option).
- D. 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.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch 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.
- 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. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 6. To Light Steel: Sheet metal screws.
 - 7. 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 blocking attached to substrate by means that meet anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 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.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.4 CONCRETE BASES

- A. Provide dowel rods to connect concrete bases to concrete floors/slabs/substrates. Unless otherwise indicated, install dowel rods on maximum 18-inch centers around the full perimeter of concrete base.
- B. Provide epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor/slab/substrate, unless concrete bases are installed directly on grade. Place and secure anchorage devices. Using setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast galvanized or stainless-steel anchor-bolt inserts into bases.
- D. Indoor bases shall be at least 3" thick and shall have straight and finished sides and a 1"-45 degree chamfer at the top perimeter. Reinforcing steel bars shall be placed in both directions of the bases. Where required for supplemental support, provide lateral support work to adjacent wall(s). Provide concrete bases/housekeeping pads beneath all electrical power and systems distribution equipment that is floor mounted or wall mounted within 4" of the floor.
- E. Outdoor bases shall be at least 6" thick and shall have straight and finished sides and a 1"-45 degree chamfer at the top perimeter. Perimeter of pads shall extend down below the frostline. Reinforcing steel bars shall be placed in both directions of the bases and a mesh overlay shall be provided. Where required for supplemental support, provide lateral support work to adjacent wall(s). Provide concrete bases/housekeeping pads beneath all electrical power and systems distribution equipment that is slab or grade mounted or mounted within 6" of slab or grade.
- F. Unless indicated otherwise in specifications or on drawings, use minimum 3000-psi, 28-day compressive-strength concrete. Size and provide concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.
- G. Forms: As required for equipment pads or other special applications in field, provide forms made of steel, wood, or other suitable material of size and strength to resist movement during concrete placement, and to retain horizontal and vertical alignment until removal. Use straight forms, free distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends. Do not remove forms for 24 hours after concrete has been placed. Set forms to required grades and lines, rigidly braced and secured. Provide sufficient quantity of forms to allow continuous progress of work, and so that forms can remain in place at least 24 hours after concrete placement. Clean forms after each use, and coat with form release agent as often as

required to ensure separation from concrete without damage. Form areas that involve termination of spare conduits below grade, or that involve continuation of conduits by others, accordingly to accommodate easy future access to the ends of conduits for future extensions.

- H. Reinforcement: Cut bars true to length with ends square and free of burrs. Provide metal expansion caps for one end of each dowel bar in expansion joints. Design caps with one end closed and minimum length of 3" to allow bars movement of not less than 1", unless otherwise indicated. Provide these for joining applications where continuous pouring cannot be accomplished.
- I. Concrete Placement: Remove loose material from subbase surface immediately before placing concrete. Check subbase and forms for line and grade before placing concrete. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Place concrete using methods that prevent segregation of mix. Use splash boards to divert the flow of concrete away from the trench sides, and to avoid dislodging soil and stones. Coordinate with Owner's Representative at least 72 hours prior to placing concrete. Line up concrete trucks as required to achieve one continuous pour where applicable. Do not backfill until a minimum of 48 hours have passed.
- J. Concrete Finishing: Smooth surface by screeding after striking-off and consolidating concrete. Provide Class A finishing. Broom finish concrete pads, and aprons around pullboxes and structures. Protect concrete from damage until acceptance of work. Exclude traffic over affected areas for at least 14 days after placement.

3.5 PLYWOOD EQUIPMENT BOARDS

- A. Plywood Equipment Boards: Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent. Provide plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than ¾ inches deep. Provide marine grade plywood where subject to moisture conditions. Provide Simpson Strong Tie (or equal) expansion screw anchors.
- B. Unless otherwise noted, boards shall be painted with two coats of good grade weatherproof flat gray non-conductive fire-retardant paint on all sides and edges (prior to mounting) and plumbed in a true vertical position. Provide nominal ½" rustproof spacers between back of plywood and wall. Cut, fit, and place plywood equipment boards accurately in location, alignment, and elevations to support and anchor electrical materials and equipment. Select fastener sizes that will not 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 members. Attach to substrates as required to support applied loads. Maintain at least 4 inches from bottom of plywood equipment boards and the finished floor surface.
- C. Unless directed otherwise in field, plywood equipment boards shall be 8 feet high by ¾ inches deep by length shown on drawings (as dimensioned or as scaled) or length as required to accommodate equipment if not indicated on drawings. Unless directed otherwise in field, provide plywood equipment boards for all indoor surface mounted panelboards and systems "head-end" equipment for all applications where located in mechanical or electrical rooms/areas and only where specifically shown on drawings for all other applications.

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END OF SECTION 26 0529

SECTION 26 0533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: 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 NFPA 70.

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel only; set-screw or compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. RNC: NEMA TC 2, unless otherwise indicated.
- B. LFNC: UL 1660.
- C. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- D. Fittings for LFNC: UL 514B.

2.3 SURFACE RACEWAYS

- A. Surface Metal Raceways: Brushed Aluminum with snap-on covers.
 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. Mono Systems.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Hubbell Wiring Systems.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- F. Cabinets:
 1. NEMA 250, Type 1, 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.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: Rigid steel conduit.
 - 2. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 - 3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
 - a. Mechanical rooms below 18" AFF.
 - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT except FMC may be utilized in existing walls.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 6. Damp or Wet Locations: Rigid steel conduit.
 - 7. Raceways for Optical Fiber or Communications Cable: EMT.
 - 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 - 2. EMT: Use all steel, compression type or all steel setscrew type, concrete tight.
 - 3. Flexible conduit: Use malleable iron, "squeeze" type, non-insulated. (For lighting fixture whips only: Use all steel or die-cast screw-in connector).
 - 4. Liquid-tight conduit: steel or malleable iron.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter. Generally run conduit and conductors as high as practicable against underside of floor slab in concrete construction or immediately below the **top chord** of bar joist construction unless otherwise shown or noted. This high level zone shall be used for running electrical raceways and shall be grouped or

racked together wherever feasible. Runs at bottom chord level or ceiling grid level are not acceptable.

- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation. Plan raceway routing to minimize the number of offsets and junction boxes.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated. All conduit shall parallel building lines.
- G. Conduit shall be run overhead and shall not be run below concrete slabs unless specifically indicated on the drawings and in the legend on the drawings.
- H. Conduit crossing building expansion joints shall have expansion provisions with grounding continuity, use special expansion fittings listed for the application. Refer to the Architectural and Structural floor plans and details for locations of expansion joints.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- J. Install pull wires in empty raceways. 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.
- K. Raceways for Data, Audio Visual and Communications Cable: Install as follows:
 - 1. 1-Inch Trade Size and Smaller: Install raceways in maximum lengths of 75 feet.
 - 2. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
 - 3. Raceway shall be installed continuously from outlet box to above edge of nearest cable tray above accessible ceiling.
 - 4. Bond raceway to cable tray with approved grounding bushing, bonding jumper and necessary fittings.
- L. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in all locations except MC may be used for lighting fixture whips.

- M. 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.
- N. Do not install wall-mounted boxes back-to-back in opposite sides of wall; in stud walls, boxes shall be on opposite side of studs.
- O. Provide access to all junction and pull boxes.
- P. Set metal floor boxes level and flush with finished floor surface. Provide trim ring compatible with finish floor system.
- Q. Pull mandrel or large swab thru conduit to assure freedom from debris before pulling wires. Use listed pulling lubricants where necessary.
- R. Provide four (4) 1 inch diameter spare conduits for each flush mounted branch circuit panelboard; extend from top of panelboard to above an accessible ceiling for future use.
- S. Contractor shall record carefully on a set of "as-built" prints, the exact location of all feeder conduits (100 amps and larger).
- T. Unless noted otherwise on the drawings, a maximum of 8 conductors shall be installed in a branch circuit conduit. This maximum is a count of all phase and neutral conductors only.

3.3 INSTALLATION OF EXPOSED CONDUIT OUTDOORS

- A. Only install conduit exposed outdoors when it is impossible to do otherwise, or only if specifically indicated for such installation case-by-case elsewhere in documents. Installation convenience, financial considerations, lack of coordination with other trades and similar rationale are not sufficient reasons for conduit sizes per NFPA 70 (National Electrical Code, NEC). Provide expansion fittings, which are Listed and labeled for the respective applications, at all building expansion joints and at maximum distances of 100 feet. Paint all such conduits with at least two coats of UV-resistant weatherproof paint. Provide colors to match respective surrounding surfaces; submit colors to Design Professional for review in advance of procuring paint.

3.4 INSTALLATION OF EXPOSED CONDUIT ON ROOFS

- 1. Only install conduit exposed on rooftops when it is impossible to do otherwise, or only if specifically indicated for such installation case-by-case elsewhere in documents. Installation convenience, financial considerations, lack of coordination with other trades and similar rationale are not sufficient reasons for doing so. In cases where conduits must be installed on rooftops, de-rate conductors and modify conduit sizes per NFPA 70 (National Electrical Code, NEC). Provide expansion fittings, which are Listed and labeled for the respective applications, at all building expansion joints and at maximum distances of 100 feet. Paint all such conduits with at least two coats of UV-resistant weatherproof paint. Provide white paint of flat rooftops that have finishes white in color, and for otherwise-colored roof finishes that are not visible from the building interior or from the ground outdoors. Elsewhere select colors to match surrounding surfaces; submit colors to Design Professional for review in advance of procuring paint.

END OF SECTION 26 0533

SECTION 26 0537 – J-HOOK PATHWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 GENERAL

- A. Conduit/Raceway/Pathway: “Conduit”, “raceway”, “pathway” and similar terms shall be taken to mean “conduit” unless specifically indicated otherwise in project manual documents, or unless specifically directed otherwise in field by Owner or Design Professionals. All such terms shall be considered synonymous for the general purposes of installation means and methods.
- B. Provide J-Hook pathway systems only for the following limited applications: Class 2 (“low voltage”) control wiring above accessible finished-ceiling systems.

- 1.2 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 J-HOOK PATHWAYS

- A. Acceptable Manufacturers: Subject to being equivalent and subject to compliance with requirements, provide product by one of the manufacturers listed below, or equivalent NRTL listed and labeled equivalent.
 - 1. Cooper B-Line (basis of design, model numbers as specified further below).
 - 2. Mono-Systems, Inc.
- B. Materials Description:
 - 1. Provide J-Hook system components that are plenum-rated (regardless of whether air plenum ceilings exist on the project). Provide J-Hooks, not Cable Fasteners, and not Bridle Rings. Provide open-top hooks, so cables can be laid into J-Hooks rather than threaded through. Provide tool-less cable retainer clips (do not use cable ties). Provide hooks sized for maximum 40% fill (in cross section) based on outside diameter of cables. Accordingly, provide multiple sets of J-Hooks along any given pathway as applicable.
 - 2. Provide necessary factory hooks, cable retainers, fasteners, attachment kits, etc. as required for complete installations.

2.2 MATERIALS AND FINISHES

- A. Provide steel units with rolled hook edges to prevent damage to cable jackets and insulation.
- B. Cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3.

- C. Cable hooks for corrosive areas shall be stainless steel, AISI Type 304.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide J-Hook support along “free-air” cable pathway routes. Provide J-Hooks at four-foot intervals and at all offsets. Route J-Hooks above ceilings through corridors and similar open areas wherever possible to minimize above-ceiling wall penetrations.
- B. Layout and install all electrical work in strict compliance with Chapter 1, Part B, Section 110.26 of the latest adopted edition of NFPA 70. Locations and routing that may be shown on plans are schematic and diagrammatic in nature. Layout all proposed pathway routing, elevations, installation methods, etc. on coordination drawings and coordinate all proposed routing with all affected trades prior to commencing with work. In addition, review the information with Owner and Design Professionals for all areas where pathways will be visible after completion of construction, to ensure a neatly organized installation occurs. Where exposed in finished areas, install in a manner that minimizes detrimental effects on room aesthetics. Install as out of site as reasonably possible.
- C. Keep pathways at least 24 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal runs above liquid and steam piping. Level and square runs, and install at proper elevations and heights. Do not begin installation of cables until J-Hook pathway installations are complete and until installations locations (end to end) are in a weatherproof environment. Install pathways so that they are accessible for cable installation after construction is complete. Install pathways with enough workspace to permit access for installing cables. Strictly adhere to factory load capacities and fill capacity. Provide factory cable retainers, fasteners, attachment kits, and other accessories as required for a complete installation.
- D. Securely anchor (mechanical, not adhesive) J-Hooks directly to structural components of the building. Do not anchor J-Hooks to ductwork, conduit, piping, fixtures, equipment, ceiling supports (rods, wires, T-bars), etc. Comply with requirements in Section 260529 and related sections for hangers and supports. Support using factory-approved methods. Fasten cables on horizontal runs with factory cable clamps, retainers, fasteners, attachment kits or flexible Velcro-secured wraps compliant with NEMA VE 2. Tighten clamps/wraps only enough to secure the cable, without indenting the cable jacket. Use of synthetic or plastic “tie-wraps”, “zip ties”, “wire ties” and similar products are not permitted as a permanent means of anchoring, securing, supporting or otherwise installing any cables, conductors, conduits, raceways, devices equipment or other electrical work. Do not use perforated strap.
- E. Coordinate work prior to rough-in with respective equipment and cable installers, and with Owner’s Representative. Carefully coordinate proposed routing, including elevations, with affected installers and entities prior to rough-in. Neatly route paths parallel and perpendicular to building architectural lines, plumb on walls, and at a consistent elevation wherever possible. Install paths in a uniform plane/elevation wherever possible. Keep horizontal and vertical offsets to an absolute minimum. Route paths so that a minimum of 24 inches exists between cables and potential EMI sources such as lighting ballasts, motors, power wiring, dimmer circuits, etc.

- F. Provide a minimum of two (2) 4-inch bushed conduit sleeves where pathway is routed above inaccessible ceilings, and at penetrations of floors, masonry walls, fire rated walls, smoke-tight partitions, smoke-related partitions, and similar elements. Provide smoke and fire stopping at such penetrations as applicable in (see Section 260502). Provide EMT conduit for “drops” from paths to outlets and equipment, with sweep bends, insulated throat fittings and 200-pound pull string.

END OF SECTION 26 0537

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SECTION 26 0543 – UNDERGROUND DUCTS AND RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
2. Handholes and boxes.

1.2 SUBMITTALS

A. Shop Drawings for Factory-Fabricated Handholes and Boxes: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Cover design.
3. Grounding details.
4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: Type EPC-40-PVC or type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B. Utilize galvanized rigid steel for 90 degree bends (long sweep type) with proper adapters between PVC duct and galvanized steel.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. 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:
1. Cantex, Inc.
 2. CertainTeed Corp.; Pipe & Plastics Group.
 3. Heritage Plastics.
 4. Carlon Electrical Products.
 5. Manhattan/CDT; a division of Cable Design Technologies.
 6. Spiraduct/AFC Cable Systems, Inc.
- B. Duct Accessories:
1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, to provide minimum duct spacings while supporting ducts during concreting or backfilling.

2.3 HANDHOLES AND BOXES

- A. Description: Comply with SCTE 77.
1. Color: Gray
 2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 5. Cover Legend: Molded lettering, As indicated for each service.
 6. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Polymer Handholes and Boxes: Molded of fiberglass-reinforced polymer concrete, with matching covers.
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. Carson Industries LLC.
 - b. Quazite (Hubbell).
 - c. Highline Products, Inc.

PART 3 - EXECUTION

3.1 EARTHWORK AND RESTORATION

- A. Refer to Division 26 Section "Excavation, Backfill and Surface Restoration".

3.2 DUCT INSTALLATION

- A. Slope: Pitch ducts 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 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends at other locations, unless otherwise indicated.
- C. Joints: Stagger couplings so those of adjacent ducts do not lie in same plane.
- D. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition.
- E. 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.
- F. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.

3.3 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: Set covers of handholes 1 inch above finished grade and boxes with bottom below the frost line.
- D. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.4 GROUNDING

- A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.5 CLEANING

- A. Pull mandrel 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 0543

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Identification for conductors and communication and control cable.
 - 2. Wiring device circuit identification.
 - 3. Warning labels and signs.
 - 4. Equipment identification labels.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

- 1.5 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Marker Tape: Vinyl or vinyl -cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 WIRING DEVICE CIRCUIT IDENTIFICATION

- A. Marker Tape: Self-laminating, clear polyester, 3/8" high tape with black lettering.

- B. Provide label on every wiring device cover plate, indicating panel and circuit breaker fed from. Utilize 12 pt. font. Mount label on face of device cover plate, centered near the top .

2.3 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 mm)."

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Phenolic Label: Adhesive backed, with black letters on a white background. Minimum letter height shall be 3/8 inch.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Electrical and Auxiliary Systems Box, Conductor and Cable Identification: Use marker tape to identify field-installed branch circuit, alarm, control, signal, sound, intercommunications, voice, and data wiring connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and cable pull points. Identify by system and circuit designation.
 - 2. Identify panel and branch circuit number(s) on all junction box covers permanently clearly printed with bold black indelible marker.
 - 3. Use system of designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
- B. Conduit and junction boxes:
 - 1. Color code or label all junction boxes and exposed conduit at 20 ft. intervals. Coding shall be painted or labels of the pre-manufactured type permanently mounted with metal or plastic band.

2. Label panelboard and branch circuit number(s) on outside of junction box cover at all junction boxes containing branch circuit wiring. Labelling shall be neatly done utilizing black indelible ink markers.
 3. Paint all junction boxes and covers for fire alarm wiring red.
- C. Branch circuit panelboards:
1. Identify panel designation on directory card within the panel.
 2. Fill out branch circuit directory indicating circuit number and area served, rooms, group of rooms, lighting, convenience outlets, motors, etc. Card index shall be neatly typed.
 3. Replace branch circuit directory in existing panelboards in areas of alteration.
 4. Branch circuit phase conductor color format shall be permanently identified inside each panelboard.
- D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
1. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- E. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated phenolic label. Unless otherwise indicated, provide a single line of text with 1/4-inch- high letters on 5/8-inch- high label; where 2 lines of text are required, use labels 1 inch high.
 2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Electrical switchgear and switchboards.
 - c. Transformers.
 - d. Disconnect switches.
 - e. Enclosed circuit breakers.
 - f. Motor starters and VFD's.
 - g. Lighting Relay Panel(s).
 3. Label shall include equipment name, voltage and where fed from. Where equipment is located in finished spaces, accessible to the public, in addition to adhesive, secure labels with screws, one on each end.

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow
 - d. Neutral: Grey.

END OF SECTION 26 0553

SECTION 26 0563 – SPECIFIC WIRING APPLICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Various items of equipment require additional electrical connections, wiring and/or interlocks that are not specifically identified on the drawings or in the specifications. Included, but not limited to, are the following items:
 - 1. Laboratory and laundry equipment.
 - 2. Mechanical/HVAC Equipment and motors.
 - 3. Plumbing Equipment
 - 4. Motorized Doors.
 - 5. Fire Protection/Suppression Equipment.

1.2 COORDINATION

- A. Coordinate wiring requirements and interlocks for equipment provided by other Contractors. Obtain copies of approved Shop Drawings and/or manufacturer's wiring diagrams to determine exact wiring requirements.
- B. This Contractor shall inquire of the Engineer during bidding, or at the earliest practical date, any questions which may arise regarding the intention and scope of this work.

- 1.3 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

- 2.1 Materials and equipment shall be as indicated on the drawings and in the specifications.

PART 3 - EXECUTION

- 3.1 Final connections to fixture pigtails shall be made with approved pressure connectors such as IDEAL “Twister” or T&B “Freespring Winged”.
- 3.2 Miscellaneous Equipment Connections
 - A. Various items of equipment such as laboratory, laundry, HVAC, Plumbing, etc. will be furnished and set in place by other trades. This equipment, unless otherwise shown on the drawings, will be furnished with necessary electrical outlets, operating and control switches,

terminating in an electrical outlet box, or equivalent electrical connector located on the equipment. This contractor shall furnish power wiring to these various items of equipment and connect them up complete for full operation.

- B. Where disconnect switches are indicated or where otherwise required, they shall be mounted in an accessible location. In the case of labs and finished areas, locate in as inconspicuous a place as possible. Locate disconnect switches under counters where feasible and accessible in lieu of above counter, however, this contractor shall ensure that the installation of equipment does not interfere with access and operation of such switches.
- C. Where necessary to expose conduit in finished spaces, rigid aluminum conduit and conduit body ("LB") fittings shall be utilized.
- D. Coordinate and provide any additional 120 volt power connections required for special low voltage systems devices or equipment panels such as Security System/Door Access System control panels, door strikes, surveillance cameras, security/fire shutters or doors, temperature control system panels/transformers, etc.
- E. Roughing-in drawings for equipment shall be obtained from the Architect or Contractor providing the equipment with substantial time prior to the installation of such equipment to enable proper electrical rough-in equipment.

3.3 Miscellaneous Wiring Interlocks

- A. Various items of work are required in connection with interlocking motor and starter/VFD operations and providing wiring to serve equipment which is furnished by other trades.
- B. The following is a list of equipment and systems requiring wiring. Note that these are in addition to standard interlocks scheduled on the drawings.
 - 1. Motorized backdraft dampers on exhaust fans and power roof ventilators shall be connected to their respective associated motor leads to energize the backdraft damper motor and open the damper when the fan operates. Dampers, operator and transformer, if required, will be furnished by the fan supplier, install transformer and wire to damper.
 - 2. Motorized Doors: Door controls, including door switches (pressplates, prox sensors, etc.), limit switches, relays, etc. will be furnished by the door equipment supplier. This equipment shall be turned over to the Electrical Contractor and installed for a complete and operational motorized door operator system per the equipment supplier wiring diagrams. Provide additional boxes, conduit and wiring as required per the supplier's diagrams and to meet field conditions. Where motorized door operators are located in fire walls and/or smoke partitions, provide a signal from the fire alarm system to disable the door controls to allow it to be manually operable while maintaining it's latching feature. Where motorized door operators are located on exterior doors and are required to open doors for smoke evacuation, provide a signal from the fire alarm system to open and hold doors during the course of smoke evacuation sequence.
 - 3. Independently mounted controllers furnished by others: Where starters/VFD's are furnished by other trades, and are required to be mounted remote from the motor, the Electrical Contractor shall accept and mount them and perform all power and control

wiring between the controls and motors indicated. Motor controllers equipped with automatic alternators shall have two independent circuits and control sources to preclude loss of operation when one circuit fails.

4. Lab gas solenoid valve(s) will be provided by the Plumbing Contractor. This Contractor shall provide maintained contact emergency stop pushbutton(s), as indicated on the floor plan(s) and wire thru 120 volt power source to power solenoid valve(s) open. Wire pushbutton so that when depressed, solenoid is de-energized and gas valve is closed.
5. Pre-Action or dry-pipe fire suppression panel(s) will be provided by the Fire Suppression Contractor. In addition to the required fire alarm system monitoring/control devices specified elsewhere in this specification, this Contractor shall provide any necessary 120 volt emergency power supply to panel for control and/or integral air compressor.

END OF SECTION 26 0563

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SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Indoor occupancy sensors.
- B. See Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Current.
 - 2. Leviton Mfg. Company Inc.
 - 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 4. Watt Stopper (The).
 - 5. Sensorswitch.
 - 6. Sensorworx.
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

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1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 6. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.
- C. Dual Technology Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
 3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.
- D. Emergency Bypass Relays:
1. Where an emergency power system is available and plans indicate control of emergency lighting via occupancy sensor controls, provide U.L. 924 Listed emergency bypass relay(s) to illuminate emergency lighting from emergency power system during a normal power outage.
- E. Application:
1. Utilize sensor type to best apply to the area it controls (i.e. office, corridor, restrooms, etc.) and provide proper quantity and spacing of sensors to adequately cover the entire area it serves.
 2. Sensors shall be located and adjusted in private office to prevent incidental activation from passerby in hallways or sensor shall utilize 'adaptive' technology to recognize usage patterns and adjust sensitivity.
 3. Provide override switch where indicated on plans to disable operation of sensor and leave lights off.

2.2 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 95 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. After construction period and just prior to turn-over of facility for beneficial use, reset all sensors that are "Adaptive Technology" (or "Smart Technology") to initiate their "learning mode" while in use by the Owner during move-in and beneficial use. Follow up with necessary sensor adjustments within 15 working days.
- C. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

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1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:

1. After installing sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION 26 0923

SECTION 26 0936 - MODULAR DIMMING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes manual modular dimming controls.

1.2 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: 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 NFPA 70.

- 1.3 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 GENERAL DIMMING DEVICE REQUIREMENTS

- A. Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.
- B. Dimmers and Dimmer Modules: Comply with UL 508.
 - 1. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
 - 2. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.

2.2 MANUAL MODULAR MULTISCENE DIMMING CONTROLS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Leviton Mfg. Company Inc.
 - 2. Lightolier Controls.
 - 3. Lutron Electronics, Inc.
 - 4. Lehigh, Inc.

- B. Description: Factory-fabricated equipment providing manual modular dimming control consisting of a wall-box-mounted, master-scene controller and indicated number of wall-box zone stations. Controls and dimmers shall be integrated for mounting in one-, two-, or three-gang wall box under a single wall plate. Each zone station shall be adjustable to indicated number of scenes, which shall be recorded on the zone controller.
- C. Operation: Automatically change variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.
- D. Each manual modular multiscene dimming controller shall include a master control and remote controls.
- E. Each zone shall be configurable to control the following:
 - 1. Fluorescent lamps with electronic ballasts.
 - 2. Incandescent lamps.
 - 3. Low-voltage incandescent lamps.
- F. Memory: Retain preset scenes through power failures for at least seven days.
- G. Device Plates: Style, material, and color shall comply with Division 26 Section "Wiring Devices."
- H. Master-Scene Controller: Suitable for mounting in a single flush wall box.
 - 1. Switches: Master off, group dim, group bright, and selectors for each scene.
 - 2. LED indicator lights, one associated with each scene switch, and one for the master off switch.
- I. Fluorescent Zone Dimmer: Suitable for operating lighting fixtures and ballasts specified in Division 26 Section "Interior Lighting," and arranged to dim number of scenes indicated for the master-scene controller. Scene selection is at the master-scene controller for setting light levels of each zone associated with scene.
 - 1. Switch: Slider style for setting the light level for each scene.
 - 2. LED indicator lights, one associated with each scene.
 - 3. Electrical Rating: 1000 VA, 120 V minimum or as noted or scheduled on the drawings.
- J. Incandescent Zone Dimmer: Suitable for operating incandescent lamps at line-voltage or low-voltage lamps connected to a transformer and arranged to dim number of scenes indicated for the master-scene controller. Scene selection shall be at the master-scene controller for setting light levels of each zone associated with scene.
 - 1. Switch: Slider style for setting the light level for each scene.
 - 2. LED indicator lights, one associated with each scene.
 - 3. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in RMS voltage.

2.3 CONDUCTORS AND CABLES

- A. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Class 2 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.2 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" for identifying components and power and control wiring.
- B. Label each dimmer module with a unique designation.
- C. Label each scene control button with approved scene description.

3.3 FIELD QUALITY CONTROL

- A. 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.
- B. Tests and Inspections:

1. Continuity tests of circuits.
2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
 - a. Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
- C. Remove and replace malfunctioning modular dimming control components and retest as specified above.
- D. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
- E. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

END OF SECTION

SECTION 26 0943 - NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes manually operated, digital lighting controls with external signal source, relays and programmable control module.
- B. See Division 26 Section "Lighting Control Devices" for occupancy sensors.

1.2 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.
- B. Monitoring: Acquisition, processing, communication, and display of equipment status data, event signals and event logs.
- C. Power Line Carrier: Use of radio-frequency energy to transmit information over transmission lines whose primary purpose is the transmission of power.
- D. RS-485: A serial network protocol, similar to RS-232, complying with TIA/EIA-485-A.

1.3 SUBMITTALS

- A. Product Data: For control modules, power distribution components, manual switches and plates, and conductors and cables.
- B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.
 - 1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
 - 2. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths, and other devices to be used. Describe characteristics of data communication lines.
 - 3. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
- C. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
 - 1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.

D. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files or obtainable as a file download from the manufacturer.
3. Device address list.

E. Field quality-control test reports.

F. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

G. Operation and maintenance data.

H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components. Match components and interconnections for optimum performance of lighting control functions.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Failure of software input/output to execute switching commands.
- b. Failure of modular relays to operate under manual or software commands.
- c. Damage of electronic components due to transient voltage surges.

2. Warranty Period: Two years from date of Substantial Completion.

3. Extended Warranty Period for Electrically Held Relays: 10 years from date of Substantial Completion.

1.7 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revise licenses for use of the software.
 1. Provide 30-day notice to Owner to allow scheduling and access to system and to allow Owner to upgrade equipment/software, if necessary.

- 1.8 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Intelligent Lighting Controls, Inc.
 2. Leviton Mfg. Company Inc.
 3. Sensorswitch.
 4. Lithonia Lighting; Acuity Lighting Group, Inc.
 5. Hubbell Lighting Control Systems.
 6. Watt Stopper (The).
 7. Lighting Control & Design (LC&D).
 8. Crestron.

2.2 SYSTEM REQUIREMENTS

- A. Expandability: System shall be capable of increasing the number of control functions in the future as scheduled on the drawings.
- B. Performance Requirements: Manual switch operation, occupancy sensor, photocell sensor or other external input device sends a signal to programmable-system control module that processes the signal according to its programming and routes an open or close command to one

or more relays in the power-supply circuits to groups of lighting fixtures or other loads. Or a programmed time of day sequence or any combination of programmed time of day sequence and/or manual input operation sends an appropriate signal to the control module to control appropriately programmed relays to open or close to control lighting or other loads.

2.3 CONTROL MODULE

- A. Control Module Description: Comply with UL 916 (CSA C22.2, No. 205); microprocessor-based, solid-state, 365-day timing and control unit. Unit shall be programmable for control of indicated number of output circuits. Output circuits shall be switched on or off by internally programmed time signals or by program-controlled analog or digital signals from external sources. Output circuits shall be pilot-duty relays compatible with power switching devices, all located in other enclosures. An integral keypad shall provide local programming and control capability. A key-locked cover and a programmed security access code shall protect keypad use. Line-voltage components and wiring shall be separated from low-voltage components and wiring by barriers. Control module shall be locally programmable. An integral alphanumeric LCD shall display manual-control and programming steps. Modules and their associated control panels shall include the following features:
1. Multichannel output with number of channels scheduled on the drawings.
 2. Multiple inputs for indicated programmable control stations and other sources.

2.4 POWER DISTRIBUTION COMPONENTS

- A. Modular Relay Panel: Comply with UL 508 and UL 916; factory assembled with modular single-pole relays, two-pole relays or contactors, power supplies, and accessory components required for specified performance.
1. Cabinet: Steel with hinged, locking door.
 - a. Barriers separate low-voltage and line-voltage components.
 - b. Relay control panel shall be available in a minimum of four sizes: 4, 16, 30 and 42 relay outputs.
 - c. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
 - d. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.
 2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type with visual indicator of relay status.
 - a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
 - b. Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments, low voltage, LED or ballasts; 20 A, 277-V ac for low voltage or ballasts.
 - c. Endurance: Minimum 30,000 cycles at rated capacity.
 - d. Mounting: Provision for easy removal and installation in relay cabinet.
 - e. Relay shall include a mechanical means of turning the relay on or off without the need of electrical power of any kind.

3. Two-Pole Relays or Contactors: Shall be of the same design and manufacture as single-pole relays with the same type of features with the addition of the following:
 - a. Contactors shall be individually UL listed and shall bear labels indicating compliance.
 - b. Rated Capacity (Mounted in Relay Panel): 20 A, for the control of 208, 240 and 480VAC loads.
 - c. Poles within the contactor shall be electrically isolated, but mechanically linked so as to open and close together without the possibility of one pole being closed while the other remains open. Systems that utilize two single-pole relays to accomplish this function are not acceptable.
4. Dry Contact Interface Module: Manufacturer shall offer a programmable interface module for control from separately provided dry contact devices.
 - a. Module shall accommodate a minimum of 4 individual dry contact inputs.
 - b. Each input shall be individually programmable to control any single relay or groups of relays or contactors.
 - c. Module shall accommodate 2 and 3 wire devices, momentary or maintained.
 - d. Module shall be topology free, polarity insensitive, 2-wire network communication with "open system" communications architecture.
 - e. Module may be programmable for active or inactive time periods.
 - f. Mounting: Provision for easy removal and installation in relay cabinet.
5. Emergency Bypass Control/Relay(s):
 - a. Where an emergency power system is available and plans indicate control of emergency lighting via network lighting controls, provide U.L. 924 Listed emergency bypass relay(s) to illuminate emergency lighting from emergency power system during a normal power outage. Automatic controls shall be "bypassed" during emergency operation.
- B. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels or field-mounting surge suppressors that comply with Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" for Category A locations.

2.5 MANUAL SWITCHES AND PLATES

- A. Push-Button Switches: Modular, momentary-contact, low-voltage type furnished with system.
 1. White with matching faceplate.
 2. Number of buttons as indicated on floor plans (or schedule) for selection of scenes and/or lighting zones/levels.
 3. Integral green or red LED pilot light to indicate when circuit is on.
- B. Manual, Maintained or Momentary Contact, Full- or Low-Voltage Switch as indicated on drawings: Comply with Division 26 Section "Wiring Devices."

- C. Wall Plates: Single or multi-gang gang plates as required by manufacturer. Coordinate backbox size required with push-button switch(es) and wallplate.
- D. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.6 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Division 26 Section "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 Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- D. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 5e for horizontal copper cable.

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Install wiring in raceways except where installed in accessible ceilings. Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.
- F. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:

1. Test for circuit continuity.
2. Verify that the control module features are operational.
3. Check operation of local override controls.

3.3 SOFTWARE INSTALLATION

- A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

END OF SECTION 26 0943

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SECTION 26 2213 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

- 1. Distribution transformers.

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Indicate dimensions and weights.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that transformers, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Field quality-control test reports.
- E. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: 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 IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
 1. Internal Coil Connections: Brazed or pressure type.
 2. Coil Material: Copper or aluminum.

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Provide transformers that are constructed to withstand seismic forces specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Cores: One leg per phase.
- D. Enclosure: Ventilated, NEMA 250, Type 2.
 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- E. Transformer Enclosure Finish: Comply with NEMA 250.
 1. Finish Color: ANSI 49 gray.
- F. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.
- 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: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- I. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 1. Complying with NEMA TP 1, Class 1 efficiency levels.
 2. Tested according to NEMA TP 2.
- 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.
- K. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
- L. Wall Brackets: Manufacturer's standard brackets.

2.4 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic nameplate. Nameplates are specified in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
- B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions and requirements in Division 26 Section "Hangers and Supports for Electrical Systems."
- C. Furnish and install a vibration isolation pad at each corner of each transformer to isolate from structure or support frame. Vibration isolation pads shall be selected for appropriate weight and bearing area; by Mason or B-Line or equal.

3.2 ADJUSTING

- A. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 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.

END OF SECTION 262200

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SECTION 26 2416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- C. Panelboard schedules for installation in panelboards.
- D. Operation and maintenance data.

1.3 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.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and/or surface-mounted cabinets, as indicated on the drawings.

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/Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 4. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Top and/or bottom as Project condition dictates.
- C. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Main and Neutral Lugs: Mechanical type.
 3. Ground Lugs and Bus Configured Terminators: Mechanical type.
 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
- H. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Square D.

2.2 DISTRIBUTION PANELBOARDS

- A. Panelboards: NEMA PB 1, power and feeder distribution type.
- B. Doors: Secured with vault-type 3 point latch with tumbler lock; keyed alike.
- C. Mains: As identified on the drawings.

- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Circuit breaker and/or lugs only as identified on the drawings. Sized to have 225 amp bussing unless indicated otherwise on drawings.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units. Sized to accommodate 42 poles unless indicated otherwise on drawings. Furnish number of breakers shown.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents listed on the drawings.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. 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. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 4. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles. Where more than one pole is used, they shall employ a common trip.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits. Type HACR for feeding heating, air conditioning and refrigeration equipment.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Shunt Trip: 120 -V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of lighting and appliance panelboard trim 72 inches above finished floor; distribution panelboard trim 90 inches above finished floor, unless otherwise indicated.
- C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- D. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges and ground fault settings as applicable.
- E. Install filler plates in unused spaces.
- F. Stub four 1-inch empty conduits from flush mounted panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- H. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Switchboards or panelboards containing a 4-wire, delta connected system where the midpoint of one phase winding is grounded shall be legibly and permanently field marked to indicate "high phase leg to ground" per (2017) NEC 408.3(F).
- C. Create a directory to indicate installed circuit loads and incorporating Owner's final room, area or equipment designations. Temporary conditions of occupancy shall not be utilized as circuit descriptions. Indicated spare circuits shall be specifically labeled as such. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- D. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- E. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Panelboards will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 2416

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SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Wall-box motion sensors.
 - 3. Snap switches and wall-box dimmers.
 - 4. Solid-state fan speed controls.
 - 5. Wall-switch and interior occupancy sensors.
 - 6. Communications outlets.
- B. See Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Legrand).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; 5361 (single), 5362 (duplex).
 - c. Leviton; 5351 (single), 5352 (duplex).
 - d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. All receptacles installed outdoors shall be weather resistant type.
- C. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper.
 - b. Pass & Seymour/Legrand.
 - c. Leviton.
 - d. Hubbell.

2.4 TAMPER RESISTANT STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, NEC 406.12 & 517.18(C) and UL 498.
- B. Where indicated on plans to provide Tamper Resistant type receptacle, device shall have non-conductive dual mechanical shutter mechanisms on 120V connection ports, compliant with NEC requirements. This is in addition to required device configuration indicated (ie: Standard Straight Blade, Hospital Grade, GFCI, etc.).

2.5 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:

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1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

- C. Pilot Light Switches, 20 A:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221PL for 120 V and 277 V.
 - b. Hubbell; HPL1221PL for 120 V and 277 V.
 - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
 - d. Pass & Seymour; PS20AC1-PLR for 120 V.
 2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

- D. Key-Operated Switches, 120/277 V, 20 A:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221L.
 - b. Hubbell; HBL1221L.
 - c. Leviton; 1221-2L.
 - d. Pass & Seymour; PS20AC1-L.
 2. Description: Single pole, with factory-supplied key in lieu of switch handle.

- E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995.
 - b. Hubbell; HBL1557.
 - c. Leviton; 1257.
 - d. Pass & Seymour; 1251.

- F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995L.

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- b. Hubbell; HBL1557L.
- c. Leviton; 1257L.
- d. Pass & Seymour; 1251L.

2.6 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, 0-10V, solid-state units with integral, quiet on-off switches. Unit listed and compatible for type of lighting controlled and rated for connected load unless larger rating is indicated for future capacity.
- B. Control: Continuously adjustable slider, with separate on-off switch; single-pole or three-way switching capability. Comply with UL 1472.

2.7 OCCUPANCY SENSORS

- A. Wall-Switch Sensors:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, manufacturer shall match that submitted for ceiling mounted occupancy sensors.
 - 3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..

2.8 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Nylon; white color.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.
 - 1. Outdoor receptacle covers shall be "In Use" type rated "Extra Duty".

2.9 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Round, die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, black finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: As noted on plans or as indicated in applicable specification section.

2.10 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 - 1. Wiring Devices: White, unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Device plates: Nylon, to match color of wiring devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to insure that devices and their boxes are protected. 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 the 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.
 - 5. All 15 or 20 amp-120V wiring devices located within 6 feet from the edge of a sink, located in Kitchens or Bathrooms or serving electric water cooler shall be GFCI protected type device.
- C. Conductors:
 - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 - 2. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 3. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtail existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
 - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - 2. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 - 3. When there is a choice, use side wiring with binding-head screw terminals.

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4. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
5. Tighten unused terminal screws on the device.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, 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.

3.2 "PLUG CONNECT/PLUG TAIL" DEVICES

- A. In lieu of terminal screw connected receptacles and switches as specified above, specialized plug-in type devices may be provided as long as it is offered by the same manufacturer and listed equivalent to the same product line specified. Permanent wiring pigtails shall be of sufficient length to enable replacement of device with standard terminal screw type device as required by Code.
- B. Where plug-in type wiring devices are provided, furnish a minimum of five (5) of each type and color device installed to the Owner as spares. Where more than one hundred (100) of any type is installed, provide a minimum of ten (10) spare devices.

3.3 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Tests for Convenience 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 not acceptable.
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.

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END OF SECTION 26 2726

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SECTION 26 2813 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Cartridge fuses rated 600-V ac and less for use in, enclosed switches, panelboards, enclosed controllers and motor-control centers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Cooper Bussman, Inc.
 - 2. Mersen.
 - 3. Littelfuse.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

- A. Feeders: Class RK1, time delay.
- B. Motor Branch Circuits: Class RK1, time delay.
- C. Other Branch Circuits: Class RK1, time delay.
- D. Control Circuits: Class CC, fast acting.

3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION 26 2813

SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Shunt trip switches.
4. Molded-case circuit breakers (MCCBs).
5. Enclosures.

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 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.
- B. Comply with NFPA 70.

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 FUSIBLE/NON-FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Square D.

- B. All starters and disconnect switches shall be of the same manufacturer unless otherwise approved.
- C. Type HD, Heavy Duty, Single Throw, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses specified when so indicated on the drawings, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 4. Lugs: Suitable for number, size, and conductor material.
 - 5. Service-Rated Switches: Labeled for use as service equipment.

2.2 SHUNT TRIP SWITCHES (Elevator Power Module)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Ferraz Shawmut, Inc.
 - 3. Littelfuse, Inc.
 - 4. Square D.
- B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- E. Accessories:
 - 1. Oiltight key switch for key-to-test function.
 - 2. Oiltight ON pilot light.
 - 3. Isolated neutral lug.
 - 4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
 - 5. Form C alarm contacts that change state when switch is tripped.
 - 6. Three-pole, double-throw, fire-safety and alarm relay; 24-V dc coil voltage.
 - 7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Suitable for number, size, trip ratings, and conductor material.
 - 3. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 4. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 5. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.

2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.
 - 3. Kitchen/Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at 6'-0" A.F.F. unless otherwise indicated.
- B. Install fuses in fusible devices.
- C. Coordinate location of devices to allow working clearances and to avoid interference with other equipment and trades.

- D. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

END OF SECTION 262816

SECTION 26 2913 - ENCLOSED MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes ac, enclosed controllers rated 600 V and less, of the following types:
 - 1. Across-the-line, manual and magnetic controllers.
- B. Refer to “Disconnect Switches” section for switch requirements.

1.2 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.
- B. Comply with NFPA 70.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed controllers, minimum clearances between enclosed controllers, and for adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.
- D. Motor starters and disconnects shall be manufactured and rated in accordance with NEMA, UL and IEEE Standards. IEC rated contactors and overloads are not acceptable.

1.3 COORDINATION

- A. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.
- B. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D Type S (Class 8536).

2.2 ACROSS-THE-LINE ENCLOSED CONTROLLERS

- A. Manual Controller: NEMA ICS 2, general purpose, Class A, with "quick-make, quick-break" toggle or pushbutton action, and marked to show whether unit is "OFF," "ON," or "TRIPPED." Manual Controllers furnished for fractional horsepower, single phase motors unless otherwise indicated on plans.
 1. Overload Relay: Ambient-compensated type with inverse-time-current characteristics and NEMA ICS 2, Class 10 tripping characteristics. Relays shall have heaters and sensors in each phase, matched to nameplate, full-load current of specific motor to which they connect and shall have appropriate adjustment for duty cycle.
- B. Magnetic Controller: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated. Provide Magnetic Controllers on all motors one horsepower and greater or any 3 phase motor, unless indicated otherwise on plans.
 1. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity. Provide fusing on control transformer primary and secondary, each phase, and grounded on the secondary.
 2. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2, Class 20 tripping characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.
 3. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 30 tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
- C. Combination Magnetic Controller: Factory-assembled combination controller and disconnect switch.
 1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL. Provide fusible disconnect only where specifically indicated on the drawings or where required by Code.
 2. Nonfusible Disconnecting Means: NEMA KS 1, heavy-duty, nonfusible switch.
 3. Circuit-Breaker Disconnecting Means: NEMA AB 1, motor-circuit protector with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

2.3 ENCLOSURES

- A. Description: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated.

1. Outdoor Locations: NEMA 250, Type 3R.

2.4 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, LED Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- C. A Hand-Off-Auto selector switch shall be mounted in the face of each starter enclosure. The selector switch shall be so wired that when it is in the Hand or Auto position, all safety controls are wired in series with the selector switch. All control devices shall be wired in the Auto position only.
- D. Provide a green LED pilot light mounted in the face of enclosure. Wire pilot light so that light will be on when motor is energized.
- E. Provide a red LED pilot light mounted in the face of enclosure. Wire pilot light so that light will be on when starter power supply is energized.
- F. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock control circuit open.
- G. Control Relays: Auxiliary and adjustable time-delay relays. Provide adjustable 0-60 second "on" time delay relay on starters where indicated on drawings and wire into the "Auto" position of the selector switch to delay starting.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.

3.2 INSTALLATION

- A. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide floor set unistrut frame to mount adjacent to equipment being controlled. Allow proper service clearances to equipment.
- B. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26 Section "Fuses."

3.3 IDENTIFICATION

- A. Identify enclosed controller, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.4 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Bundle, train, and support wiring in enclosures.
- B. Install all other control and interlock wiring in the field that cannot be factory pre-wired and is indicated on the plans or other specification sections as wired by the Electrical Contractor.
- C. Connect hand-off-automatic switch and other automatic-control devices where applicable.
 - 1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
 - 2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
 - 3. Test electrical phase rotation of 3-phase supply feeders.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Correct malfunctioning units and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION 26 2913

SECTION 26 4313 – SURGE PROTECTIVE DEVICES (SPD) FOR LOW-VOLTAGE ELECTRICAL
POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes SPD's for low-voltage power equipment.

1.2 QUALITY ASSURANCE

- A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer. Manufacturer shall have been engaged in the manufacture of SPD products specified and products shall have been in satisfactory service for not less than 5 years.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."
- D. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."
- E. Comply with UL 1283 5th Edition, "Electromagnetic Interference Filters," and UL 1449 3rd Edition, "Surge Protective Devices."

1.3 PROJECT CONDITIONS

- A. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 - 2. Operating Temperature: 30 to 120 deg F.
 - 3. Humidity: 0 to 85 percent, non-condensing.
 - 4. Altitude: Less than 20,000 feet above sea level.

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advanced Protection Technologies, Inc. (ASCO)
 2. Current Technology, Inc. (ABB)
 3. Liebert Corporation.
 4. Thor Systems, Inc.
 5. Square D.
 6. LEA International.

2.2 SERVICE ENTRANCE SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. Fuses/circuit breaker, rated at 200-kA interrupting capacity.
 4. Integral disconnect switch or circuit breaker to isolate entire suppressor components for repair/replacement.
 5. Redundant suppression circuits.
 6. Surge-event operations counter.
- B. Peak Single-Impulse Surge Current Rating: 150kA per mode (300 kA per phase).
- C. Connection Means: Permanently wired.
- D. SPD and overcurrent/disconnect device shall have a short circuit current rating greater than that available on the electrical system.
- E. Protection modes and UL 1449 voltage protection rating compatible with system voltage and configuration as indicated on the drawings for complete protection as follows:
1. Line to Neutral.
 2. Line to Ground.
 3. Neutral to Ground.

2.3 PANELBOARD SUPPRESSORS

- A. Same characteristics and requirements as service entrance suppressors with the following exceptions:
- B. Surge-event operations counter not required.
- C. Peak Single-Impulse Surge Current Rating: 65kA per mode (130 kA per phase).

2.4 ENCLOSURES

- A. NEMA 250 (or better), with type matching the enclosure of panel or device being protected.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

- A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.
- B. Install devices for panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible (not to exceed 18 inches). Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground. Twist input conductors together to reduce system inductance.
 - 1. Provide multipole circuit breaker or fusible disconnect switch as a dedicated disconnect for suppressor, fuse size and type as recommended by SPD manufacturer.

3.2 PLACING SYSTEM INTO SERVICE

- A. Do not energize or connect service equipment to their sources until surge protection devices are installed and connected.

3.3 FIELD QUALITY CONTROL

- A. Testing: Perform the following field tests and inspections and document on test reports:
 - 1. Complete startup checks according to manufacturer's written instructions.

END OF SECTION 26 4313

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SECTION 26 5113 - INTERIOR LIGHTING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior lighting fixtures, light engines (LED's) and drivers.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.
- B. See Division 26 Section "Wiring Devices" for manual wall-box dimmers for LED fixtures or lamps.
- C. See Division 26 Section "Lighting Control Devices" for automatic control of lighting, including occupancy sensors, and multi-pole lighting relays and contactors.

1.2 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes and photometric data.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
- C. LED Fixtures: Fixtures with LED light source are noted on lighting fixture schedule with advertised lumen output of light source for fixture/manufacturer specified and color temperature. Listed equal manufacturer shall provide fixture with equivalent lumen output as listed product. If insufficient information is provided, the Engineer may require Project Specific, point-by-point photometric calculations of sample areas utilizing the submitted fixture to prove equivalent performance.
- D. Product Certificates: For each type of driver, signed by product manufacturer.
- E. Utility Company Energy Rebate Programs
 - 1. LED lighting fixtures shall be Energy Star or DLC listed to comply with local Utility Company Rebate Programs. Does not apply to track lighting fixtures. Fixture submittals that do not have either of these listings clearly indicated in the product data shall be rejected.
- F. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. All LED fixtures and components shall be tested and comply under the standards of IESNA LM-79-08, LM-80-08, LM-82-12 and TM-21-11 for measurement and publication of projected long term lumen maintenance, color stability, photometric performance and LED source operating lifetime. Fixture submitted shall meet the listed lifetime rating of the fixture specified, as a minimum.

1.4 WARRANTY

- A. Provide a written, five year replacement material warranty for defective or non-starting LED source assemblies. Warranty period shall begin on date of installation.

1.5 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In Lighting Fixture Schedule the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified on drawing schedule.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with UL 1598 and NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Polymer Components: Plastic or polymer housing/components of fixture assemblies shall be rated for the temperature (or plenum) environment installed and shall not degrade in structural integrity, shape, color or finish for a minimum of 10 years.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit servicing without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during servicing and when secured in operating position.
- F. Plastic Diffusers, Covers, and Globes:

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1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
 - b. UV stabilized.
 2. Glass: Tempered glass, unless otherwise indicated.
- G. Servicing Access: Fixtures specified for installation in inaccessible (gypsum/drywall) ceilings/walls, etc. shall be fully serviceable/accessible from the fixture aperture.
- H. Disconnecting Means:
1. Lighting fixtures with luminaires that utilize double-ended lamps and contain driver(s) that can be serviced in place or luminaires that are supplied from multi-wire branch circuits and can be serviced in place shall have a local disconnecting means at/within the fixture complying with NEC Article 410.75.

2.3 DRIVERS

- A. Drivers for LED Light Sources:
1. Driver shall be separate component from LED light source and shall be replaceable utilizing mounting screws, factory provided clips and electrical connector bodies.
 2. Dimming (When noted or indicated on Fixture Schedule): 100 to 1 percent of rated lumens via separate 0-10V input (Dimmer) control. Line voltage dimming acceptable when noted on plans.
 3. Level Control/Step-Dimming (When noted or indicated on Fixture Schedule): Minimum capability of bi-level control (100%-50%-Off) or 1/3-2/3-Full on, as noted.
 4. Voltage input: 120-277 Volt multi-volt capability.
- B. Internal-Type Emergency Fluorescent Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with driver. Comply with UL 924.
1. Emergency Connection: Operate light source continuously at a minimum output of 1000 lumens. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture driver.
 2. Test Push Button and Indicator Light: Visible and accessible without opening fixture 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. Voltage input: 120-277 Volt multi-volt capability.

- C. Where plans call for multi-level switching/lighting, provide appropriate driver in fixture as required to accommodate the switching level arrangement of fixture.

2.4 EXIT SIGNS

- A. Internally Lighted Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

1. Light source for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
2. Voltage input: 120-277 Volt multi-volt capability.

2.5 EMERGENCY LIGHTING UNITS

- A. Description: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. 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.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Voltage input: 120-277 Volt multi-volt capability.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gauge.
- C. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- D. Recessed fixtures shall be supported at all 4 corners, independent of each other, from structure above with steel #12 single jack chains. Additionally, securely fasten each fixture to the ceiling framing member by mechanical means such as bolts, screws, rivets or approved clips; install a minimum of one on each four sides of fixture.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls.
- B. Comply with NFPA 70 for minimum fixture supports.
- C. Suspended Lighting Fixture Support:
 - 1. Single or Continuous Rows: Provide manufacturer required quantity of suspension cables at minimum intervals to support continuous row fixtures. The E.C. shall support suspended fixtures independently from the ceiling system and as specified by the fixture manufacturer.
- D. Surface or Flush Lighting Fixture Support:
 - 1. The E.C. shall coordinate fixture locations with the trade installing the ceiling system to assure support members are oriented and located to accommodate the lighting fixture layout.
 - 2. Surface or flush fixtures in ceilings of the suspended lay-in type shall be installed so that the long dimension of the fixture is supported on the main support members of the ceiling system.
- E. Luminaires installed in exposed or concealed locations under metal corrugated sheet roof decking shall be installed and supported so there is not less than 1-1/2" measured from the lowest surface of the roof decking to the top of the luminaire.
- F. Adjust aimable lighting fixtures to provide required light intensities.
- G. Where fixtures are suspended in Mechanical/Electrical/Storage/Technology or Utility spaces with no suspended ceiling, coordinate mounting heights and locations with exposed ductwork, piping, conduit/data cabling racks, equipment, etc. to provide optimal and even light distribution to service equipment.
- H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Where applicable, verify transfer from normal power to battery and retransfer to normal.

3.3 SPARE FIXTURES

- A. For LED fixtures with LED source integral to the fixture assembly, provide spare fixture for each type as noted on lighting fixture schedule.

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END OF SECTION 26 5113

SECTION 26 5600 – EXTERIOR AREA LIGHTING

PART 1 - GENERAL

- 1.1 Work includes complete new exterior lighting including luminaires, lamps, poles, bases, conduit, conductors, fusing, control devices, etc. as shown on the drawings. Include all excavation, backfill, concrete bases and encasement of underground conduits as detailed on the drawings.
- 1.2 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

- 2.1 Refer to data on the drawings for fixture details.
- 2.2 Aluminum poles, when specified, shall include a vibration dampener provided by the manufacturer.
- 2.3 Exterior building mounted lights utilized for emergency egress shall incorporate multiple drivers/LED sources where a single fixture is utilized at an exterior exit.
- 2.4 Where noted on plans, fixture poles shall have provisions for receptacle(s), security camera(s) and wireless access point(s). Mounting height and location determined at time of submittal review.

PART 3 - EXECUTION

- 3.1 Concrete bases for standards shall be round extending above finish grade as detailed on the drawings with rounded corners and rubbed finish. Furnish anchor bolts as recommended by the manufacturer. Concrete bases shall be poured-in-place at the job site; steel reinforced concrete, minimum 3500 lb. test.
- 3.2 Provide a surge arrester behind the handhole in pole base of each lighting standard and connect to each phase conductor and 0.625" diameter by 10 ft. long copper clad driven ground rod providing a good grounding path. Connect the equipment grounding conductor to this grounding terminal. A separate ground rod is required for each lighting standard exceeding 15 ft. in height. Surge arresters shall be Square D Series SDSA, Joslyn Model Series 1250 or G.E. 9L15E and F Series. Install per NEC Article 280.

- 3.3 Provide Buss “KTK” fuses in HEB waterproof in-line holder ahead of the ballast in each “hot” leg; locate behind handhole in pole base.
- 3.4 Consult manufacturer of pole and fixture(s) for recommended installation methods.
- 3.5 Mount standards truly vertical. Shim and grout under fixture base to level standards, visible shims are not acceptable. Provide anchor bolt covers.
- 3.6 Splicing shall be made with approved and UL Listed, waterproof splicing kits and shall be located in base of poles behind handhole or in splice box if indicated on plans.
- 3.7 Install a green ground wire throughout the underground wiring system and bond to all standards.

END OF SECTION 26 5600

SECTION 26 6102 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers expansion and additions to the existing fire alarm system, including initiating devices, notification appliances, controls and supervisory devices.
- B. Work covered by this section includes the furnishing of labor, equipment and materials for installation of the fire alarm system as indicated on the drawings and specifications.
- C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:
 - 1. Fire alarm and detection operations.
 - 2. Control and monitoring of elevators and other equipment as indicated in the drawings and specifications.

1.2 Acceptable Manufacturer

- A. Manufacturer: The equipment and service described in this specification are those supplied and supported by Simplex Grinnell Johnson Controls to match the existing fire alarm system.
- B. Utilize, upgrade an extend existing fire alarm system. Modify existing main panel as required to accommodate new fire alarm devices.
- C. Equipment manufacturer shall have a service organization within 60 miles of the project site and be a U.L. certified company. All equipment and materials necessary for proper operation of the system shall be deemed part of these specifications even if not specifically listed or described in this document.

1.3 Related Documents

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 1 and 26 Specification Sections, apply to this section.
- B. The work covered in this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:
 - 1. Division 26: "Common Work Results for Electrical."
 - 2. Division 26: "Control Voltage Electrical Power Cables."
- C. The system and all associated operations shall be in accordance with the following:
 - 1. Guidelines of the following Building Code: BOCA

2. NFPA 72, National Fire Alarm Code
3. NFPA 70, National Electrical Code
4. NFPA 101, Life Safety Code
5. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
6. Other applicable NFPA standards
7. Local Jurisdictional Adopted Codes and Standards
8. ADA Accessibility Guidelines

1.4 System Description

- A. General: Provide modifications to existing fire alarm system to provide a complete, non-coded, addressable microprocessor-based fire alarm system expansion and upgrade with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.
- B. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory. System shall be capable of storing dual configuration programs with one active and one in reserve. Panel shall be capable of full system operation during a new configuration download.
- C. Elevator Fire Service Mode Controls
 1. Alarm condition from any associated elevator machine room smoke detector(s) shall initiate control signals for primary and alternate elevator recall. Provide programmable relays located in the elevator machine room to perform these functions. Alarm condition from any non-primary egress level elevator lobby (or top or bottom of elevator shaft) smoke detector, shall initiate the primary recall function. Alarm condition from the primary egress level elevator lobby (or elevator machine room) smoke detector shall initiate the alternate recall function. The smoke detectors for elevator recall service shall conform to NFPA 72 and ANSI A17.1.
 2. Alarm condition from smoke detector(s) in the elevator machine room, bottom of the elevator shaft or at the top of the elevator shaft shall initiate a control signal for fireman's elevator alert operation. Provide programmable relay in elevator machine room to perform this function.
 3. Alarm condition from heat detector(s) (located adjacent to fire suppression sprinkler head(s)) in elevator machine room, bottom of the elevator shaft or at the top of the elevator shaft (if applicable) shall initiate a control signal to activate the elevator power shunt-trip. Provide programmable relay adjacent to elevator power module in machine room to perform this function.

4. Upon loss of voltage to the control circuit for the elevator shunt-trip device, initiate a supervisory trouble signal to the main control panel and remote annunciator(s). Provide a programmable monitoring module adjacent to elevator power module in machine room to perform this function.
 5. For each elevator (or elevator group), provide required interface modules in NEMA 1 enclosure within 3 feet of the elevator controller for connections for fire emergency service mode operations. Extend control wiring from relays to each controller for final connection to controller by the Elevator Contractor. Extend #12 AWG wiring to the shunt-trip breaker and control voltage sensing in the elevator machine room. Coordinate all control wiring requirements with the Elevator Contractor prior to rough-in.
- D. In the event of an operating power failure or an open or a grounded circuit in the system, a trouble signal and a trouble light shall be activated until the problem is corrected and the system is restored to normal. The trouble event shall be recorded in the system history log and printed on the system printer (when applicable). The trouble may be silenced by means of a button on the main control panel. Upon restoration of the system to a normal condition, the trouble light shall extinguish.
- E. History Logs: the system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.
- F. Wiring/Signal Transmission:
1. Transmission shall be hardwired, using separate individual circuits for each zone of alarm operation as required or addressable signal transmission, dedicated to fire alarm service only.
 2. System connections for initiating circuits and notification appliance circuits shall be Class B.
 3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.
- G. Required Functions:
1. Priority of Signals: Alarm events have the highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second, third and fourth level priority respectively. Signals of a higher-level priority take precedence over signals of lower priority even if the lower-priority condition occurs first. Annunciate all events regardless of priority or order received.
 2. Non-interfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent activations.
 3. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote annunciator and shall indicate the location and type of device.

4. General Alarm: A system general alarm shall include:
 - a) Indication of alarm condition at the FACP and annunciator.
 - b) Identification of the device or zone that is the source of the alarm at the FACP.
 - c) Operation of audible and visible notification devices throughout the building until silenced at FACP or annunciator.
 - d) Shutting down supply and return fans serving zone where alarm is initiated.
 - e) Closing smoke dampers on system serving zone where alarm is initiated.
 - f) Initiation of elevator recall in accordance with ASME/ANSI A17.1, when specified detectors or sensors are activated.
5. Supervisory Operations: Upon activation of a supervisory device such as fire pump power failure, low air pressure switch and tamper switch, the system shall operate as follows:
 - a) Activate the system supervisory service audible signal and illuminate the LED (display) at the control unit and the graphic annunciator.
 - b) Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED “on” indicating abnormal condition.
 - c) Record the event in the FACP historical log.
 - d) Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.
6. Alarm Silencing: If the “Alarm Silence” button is pressed, all audible devices shall cease operation and the visual devices will continue to flash until acknowledged.
7. System Reset:
 - a) The “system Reset” button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps (“IN PROGRESS”, “RESET COMPLETED”) as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-arming the system. The display message shall indicate “ALARM PRESENT, SYSTEM RESET ABORTED.”
 - b) Should an alarm condition continue, the system will remain in an alarmed state.
8. Automatic Alarm Sequence:
 - a) The automatic alarm signal shall consist of a Code-3 temporal pattern (master coded) audible fire alarm signal and illuminate fire signal lights in a synchronous mode until alarms have been silenced at the main fire alarm system control panel or at a remote operator’s control panel by means of the “alarm silence” switch; or the device returned to normal and a “reset” switch is manually actuated.
9. Operating Power Failure:

- a) In the event of an operating power failure or an open or a grounded circuit in the system, a trouble signal and trouble LED shall be activated until the system is restored to normal. The trouble event shall be recorded within the control panel history trouble log and printed on the system printer (if applicable). The trouble signal may be silenced by means of a button located on the control panel operator's interface. Upon restoration of the system to normal condition, the trouble indicator(s) shall automatically extinguish.

H. Analog Smoke Sensors:

1. Monitoring: The FACP shall individually monitor sensors for calibration, sensitivity and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt and other conditions that could affect detection operations.
3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements. The reports shall be viewed on a display monitor or printed for annual recording and logging of the calibration maintenance schedule.
5. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to indicate that sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate that a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." If this indicator is ignored, a second level "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported at the Remote Annunciator. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.
6. The FACP shall continuously perform an automatic self-test on each sensor, which will check sensor electronics to ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.
7. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.

8. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.
 9. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.
- I. Fire Suppression Monitoring:
1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
 2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
 3. WSO: Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.
- J. Power Requirements:
1. The control unit shall receive AC power via a dedicated circuit.
 2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
 3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit.
 4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously while incoming power is present.
 5. The system batteries shall be supervised so that a low battery or depleted battery condition or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.
 6. The system shall support NAC Lockout feature to prevent subsequent activation of NA Circuits after a depleted battery condition occurs in order to make use of battery reserve for front panel annunciation and control.
 7. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
 8. Loss of primary power shall sound a trouble signal at the FACP. The FACP shall indicate when the system is operating on an alternate (battery or generator) power supply.

1.5 Submittals

- A. General: Submit the following according to conditions of contract and Divisions 1 and 26 Specifications sections.
1. Product data sheets for system components highlighted or marked to indicate the specific products, features or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds or does not comply with this specification.
 2. Wiring diagrams from Manufacturer's Vendor.
 3. Shop drawings showing system details including location of FACP, all devices, circuiting and details.
 4. System power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.
 5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, NAC, relay, sensor and auxiliary control circuits.
 6. Operating instructions for FACP.
 7. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type of product, including all features and operating sequences, both automatic and manual. Provide the names, addresses and telephone numbers of service organizations.
 8. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with specified requirements.
 9. Record of field tests of system.
- B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions if required to make clarifications or revisions to obtain approval.

1.6 Quality Assurance

- A. Installer Qualifications: A factory authorized installer with the appropriate NICET level certification for installation is required to perform the work of this section.
- B. Each and all items of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by UL Inc. and shall bear the UL label.

1.7 Extra Materials

- A. General: Furnish extra materials, packaged with protective covering for storage and identified with labels clearly describing contents as follows:
1. Horn Strobe units: Furnish quantity equal to ten (10) percent of the number of units installed, but not less than two (2), plus 50 ft. of wire and conduit, installed at the Engineer's direction.
 2. Smoke Detectors or Sensors: Furnish quantity equal to ten (10) percent of the number installed, but not less than one (1) of each type, plus 50 ft. of wire and conduit, installed at the Engineer's direction.
 3. Detector or Sensor Base(s): Furnish quantity equal to two (2) percent of the number of units of each type installed but not less than one (1) of each type, plus 50 ft. of wire and conduit, installed at the Engineer's direction.
 4. Addressable Circuit Interface Modules: Furnish quantity equal to ten (10) percent of the number of units installed, but not less than one (1), plus 50 ft. of wire and conduit, installed at the Engineer's direction.

1.8 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 Fire Alarm Control Panel (FACP)

Existing control panel to be modified as required to support expansion and be reused."

2.2 Emergency Power Supply

- A. General: Components include battery, charger and an automatic transfer switch.
- B. Battery: Sealed lead-acid. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 15 minutes.

2.3 Addressable Manual Pull Stations (Simplex 4099-9003)

- A. Description: Addressable single-action type, red LEXAN with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.

- B. Protective Shield: Where indicated on plans, provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85 dB at 10 feet and shall be powered by a 9 VDC battery.

2.4 Smoke Sensors (Simplex 4098-9714)

- A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
 - 1. Factory Nameplate: Serial number and type identification.
 - 2. Operating Voltage: 24 VDC, nominal.
 - 3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
 - 4. Plug-in Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.
 - 5. Each sensor base shall contain an LED that will flash each time it is scanned by the control unit (once every 4 seconds). In an alarm condition, the sensor base LED shall be on steady.
 - 6. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
 - 7. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
 - 8. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.
 - 9. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.
 - 10. Removal of the sensor head for cleaning shall not require the setting of the addresses.
- B. Type: Smoke sensors shall be of the photoelectric or combination photoelectric/heat type.
- C. Bases: Relay output, sounder and isolator bases be supported alternatives to the standard base. (Simplex 4098-9791).

- D. Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific size and installation conditions where applied. Sensor includes relay as required for fan shutdown. (Simplex 4098-9756).
1. Environmental compensation, programmable sensitivity settings, status testing and monitoring of sensor dirt accumulation for the duct sensor shall be provided by the FACP.
 2. The duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A @ 28 VDC or 10A @ 120 VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
 3. Duct Housing shall provide a relay control trouble indicator Yellow LED. (Simplex 2088-9021).
 4. Compact Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
 5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
 6. Duct Housing shall provide a magnetic test area and Red sensor status LED.
 7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
 8. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch (Simplex 2098-9806).
 9. Where indicated, a NEMA 4X weatherproof duct housing enclosure shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.

2.5 Heat Sensors (Simplex 4098-9733)

- A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.
- B. Thermal sensor shall be of the epoxy encapsulated electronic design It shall be thermistor based, rate-compensated, self-restoring and shall not be affected by thermal lag.
- C. Sensor fixed-temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.

- D. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

2.6 Addressable Circuit Interface Modules (Simplex 4090-9001)

- A. Addressable Circuit Interface Modules: Arrange to monitor one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices and for control of evacuation indicating appliances and HVAC systems.
- B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include coverplates to allow surface or flush mounting. Modules will receive their operating power from the signaling line or a separate two-wire pair running from an appropriate power supply as required. (Simplex 4090-9003).
- C. There shall be the following types of modules:

1. Type 1: Monitor Circuit Interface Module:

- a) For conventional 2-wire smoke detector and/or contact device monitoring with Class B wiring supervision. The supervision of the zone will be Class B. This module will communicate status (normal, alarm, trouble) to FACP.
- b) For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.

2. Type 2: Line Powered Monitor Circuit Interface Module:

- a) This type of module is an individually addressable module that has both its power and its communications supplied by the 2-wire multiplexing signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACP.
- b) This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal and short). The 2-wire signaling line circuit shall supply power and communications to the module.

3. Type 3: Single Address Multi-Point Interface Modules:

- a) This multipoint module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status conditions (normal, open, current limited and short). The input circuits and output relay operation shall be controlled independently and disabled separately.
 - b) This dual point module shall provide a supervised multi-state input and a relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited and short). The 2-wire signaling line circuit shall supply power and communications to the module.
 - c) This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single address. The 2-wire signaling line circuit shall supply power and communications to the module.
 - 4. Type 4: Line Powered Control Circuit Interface Module:
 - a) This module shall provide control and status tracking of a Form “C” contact. The 2-wire signaling line circuit shall supply power and communications to the module.
 - 5. Type 5: 4-20 mA Analog Monitor Circuit Interface Module:
 - a) This module shall communicate the status of a compatible 4-20 mA sensor to the FACP. The FACP shall annunciate up to three threshold levels, each with custom action message; display and archive actual sensor analog levels; and permit sensor calibration date recording.
 - D. All circuit interface modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LED’s shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.
- 2.7 Magnetic Door Holders
- A. Description: Units shall be listed to UL 228. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Unit shall operate from a 24 VDC source and develop a minimum of 25 lbs. holding force.
 - B. Material and Finish: Match door hardware.

2.8 Standard Alarm Notification Appliances

- A. Visible/Only: Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with flash intensity of 15 to 110 Cd, depending on spacing and location to comply with NFPA 72. Provide a label inside the strobe lens to indicate the candela rating setting of the specific appliance.
- B. Horn/Visible: Combination Horn/Visible (H/V) units combine the horn and visible functions into a common housing. The H/V shall be listed to UL 1971 and UL 464. (Simplex 4903-Series).
 - 1. Twisted/shielded wire is required for speaker connections on a standard 25 VRMS or NAC; and UTP conductors, having a minimum of 3 twists per foot, is required for addressable strobe connections.
 - 2. The following horn shall have a minimum UL rated SPL of 84 dBA at 10 feet.
 - 3. The H/V shall install directly to a 4" square, 1 1/2 in. deep electrical box with 1 1/2 in. extension.
 - 4. Provide a wireguard on units subject to impact, Gymnasium Exterior Units and Mechanical Rooms. (Simplex 4905-9961).
- C. Horn: Horn notification appliances shall be listed to UL 464. (Simplex 4903-Series).
 - 1. The horn shall operate on a standard NAC using twisted/shielded wire.
 - 2. The horn shall have a minimum UL rated SPL of 84 dBA at 10 feet.
 - 3. The horn shall install directly to a 4" square, 1 1/2 in. deep electrical box with 1 1/2 in. extension.
- D. Notification Appliance Circuit provides synchronization of strobes at a rate of 1Hz and operates horns with an On Steady operation. The circuit shall provide the capability to silence the audible signals, while the strobes continue to flash, over a single pair of wires. The capability to synchronize multiple notification appliance circuits shall be provided. All building strobes shall be synchronized to each other.
- E. Accessories: The contractor shall furnish the necessary accessories.

2.9 NAC Power Extender (Simplex 4009)

- A. The IDNet NAC Power Extender panel shall be a stand-alone panel capable of powering a minimum of 4 notification appliance circuits. Notification appliance circuits shall be Class B Style Y rated at 2 amps each.
- B. The internal power supply and battery charger shall be capable of charging up to 12.7 Ah batteries internally mounted or 18 Ah batteries mounted in an external cabinet.
- C. The NAC extender panel may be mounted close to the host control panel or can be remotely located. The IDNet Addressable NAC Extender Panel, when connected to an addressable panel, shall connect to the host panel via an IDNet communications channel. Via the IDNet channel, each output NAC can be individually controlled for general alarm or selective area notification.
- D. For IDNet connected NAC extender panels, up to five (5) panels can be connected on a single IDNet channel.
- E. When connected to a conventional (non-addressable) panel, one or two standard notification appliance circuits from the main control panel may be used to activate all the circuits on the NAC power extender panel.
- F. Alarms from the host fire panel shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel.

2.10 Digital Communicator and Building Access

- A. A digital communicator shall be located within the main fire alarm control panel to automatically transmit designated alarms, supervisory and trouble signals to a central station monitoring service via dedicated telephone lines. The digital communicator shall be compatible with the communications protocol of all major Central Station receivers, including: ADCOR, ADEMCO, FBI, Franklin, Osborne Hoffman, Radionics, SESCOA, Silent Knight, Varitech, DCI, Vertex, etc. The main fire alarm panel shall have all provisions for the installation of a digital communicator furnished and installed by the owner contracted Central Monitoring Service. The digital communicator shall be connected to one telephone line and a cellular dialer, shall supervise both means of communication and shall be capable of sending alarm signals on both means of communications to the Central Monitoring Service. The fire alarm panel shall indicate a trouble alarm on any digital communicator equipment failure (including loss of telephone line connection for longer than 45 seconds). The digital and cellular dialer shall be powered and maintained by the main fire alarm control panel standby battery power supply. Provide surge suppression on the 120 volt power supply and on one telephone lines. Provide both digital and cellular dialers and one year of UL monitoring.

The digital communicator shall transmit the following event level information:

- 1. Fire Alarm Condition
- 2. Supervisory Condition
- 3. Trouble Condition
- 4. Daily Test Signal

- B. Provide a recessed Knox-Box rapid entry system with tamper switch where indicated on drawings. Extend wiring from the Knox-Box tamper switch to a monitor module to signal a trouble to the building fire alarm system.

PART 3 - EXECUTION

3.1 Installation, General

- A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.
- B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
 - 1. Factory trained and certified personnel.
 - 2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
 - 3. Personnel licensed or certified by state or local authority.

3.2 Equipment Installation

- A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes and all other necessary material for a complete operating system.
- B. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.
- C. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

3.3 Wiring Installation

- A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electrical Code (NEC).
- B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

- C. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuit wiring and a different color code for supervisory circuits. Color code notification appliance circuits differently from alarm initiating circuits. Paint fire alarm system junction boxes, conduit fittings and box covers red.
- D. The following wiring and conduit shall also be included in the fire alarm system work:
 - 1. From duct mounted smoke detector, control relay module or fire alarm panel to each air handling unit.
 - 2. For each elevator or elevator group:
 - a. Provide 2-#12 from the shunt-trip control relay module to the elevator shunt-trip breaker.
 - b. Provide 2-#12 from the elevator shunt-trip control voltage sensing to a monitoring module.
 - c. Provide 2-#14 from the fireman's hat indicator control relay module to the elevator controller for activation of the fireman's alert signal within the elevator cab.
 - d. Provide 2-#14 from the primary recall control relay module to the elevator controller (or group of controllers) for elevator "primary egress level" emergency service mode signaling.
 - e. Provide 2-#14 from the alternate recall control relay module to the elevator controller (or group of controllers) for elevator "alternate egress level" emergency service mode signaling.
 - f. Elevator emergency service mode signal wiring shall be from Form C dry contacts in each control relay in accordance with the elevator supplier's direction.
 - 3. From electro-mechanical door holders to associated smoke detectors and/or fire alarm panel or control relay.
 - 4. Wiring to supervisory monitor and control points.

3.4 Field Quality Control

- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing and adjustment of the system.
- B. Service personnel shall be qualified and experienced in the inspection, testing and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
 - 1. Factory trained and certified personnel.
 - 2. National Institute of Certification in Engineering Technologies (NICET) fire alarm certified.
 - 3. International Municipal Signal Association (IMSA) fire alarm certified.
 - 4. Certified by state or local authority.

5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.

- C. Pre-testing: Determine, through pre-testing, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pre-testing. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
- D. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.
- E. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72.
- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
- G. Report of Tests and Inspections: Provide a written record of inspections, tests and detailed test results in the form of a test log.
- H. Final Test, Certificate of Completion and Certificate of Occupancy:
 1. Test the system as required by the Authority Having Jurisdiction (AHJ) in order to obtain a certificate of occupancy.

3.5 Cleaning and Adjusting

- A. Cleaning: Remove paint splatters and other spots, dirt and debris. Clean unit internally using methods and materials recommended by manufacturer.
- B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Test fire-alarm system for compliance with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections. Provide up to three (3) visits to the site for this purpose.

3.6 Training

- A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel for a minimum of 4 hours training on-site.

END OF SECTION 26 6103

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SECTION 26 7533 - RACEWAY AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for communications systems including voice, data, fire alarm and other remote-control, signaling and power-limited circuit systems.

1.2 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, cable trays, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: 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 NFPA 70.
- C. Comply with ANSI/EIA/TIA 569.

- 1.4 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.

- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

- 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT: Steel only, set-screw or compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. ENT: NEMA TC 13.
- B. RNC: NEMA TC 2, unless otherwise indicated.
- C. LFNC: UL 1660.
- D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: UL 514B.

2.3 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Single-gang deep box for wall-phone, minimum two-gang box with single-gang extension ring for all others.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

2.4 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: Rigid steel conduit.
 - 2. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 - 3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:

- a. Mechanical rooms: EMT.
 - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT except FMC may be utilized in existing walls.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 6. Damp or Wet Locations: Rigid steel conduit.
 - 7. Raceways for Optical Fiber or Communications Cable: EMT.
 - 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
- 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2.5 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Install no more than the equivalent of two 90-degree bends in any conduit run or .
- F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- G. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- H. Install pull wires in empty raceways. 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.
- I. Raceways for Data, Audio Visual and Communications Cable: Install as follows:
 - 1. 1-Inch Trade Size and Smaller: Install raceways in maximum lengths of 75 feet.
 - 2. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

3. Raceway shall be installed continuously from outlet box to above edge of nearest cable tray above accessible ceiling.
 4. Bond raceway to cable tray with approved grounding bushing, bonding jumper and necessary fittings.
- J. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in all locations except MC may be used for lighting fixture whips.
- K. 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.
- L. Set metal floor boxes level and flush with finished floor surface.

2.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 26 7561 – VOICE AND DATA COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP cabling.
3. Cabling identification products.

1.2 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
1. Bridged taps and splices shall not be installed in the horizontal cabling.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 2. Cabling administration drawings and printouts.
- C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
- D. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 50 or less.
- 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.
- D. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- E. Grounding: Comply with ANSI-J-STD-607-A.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.

- 1.7 Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Cable Support: NRTL labeled for support of Category 5E and 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
1. Support brackets with cable tie slots for fastening cable ties to brackets.
 2. Lacing bars, spools, J-hooks, and D-rings.
 3. Straps and other devices.
- B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Communications Systems." Flexible metal conduit shall not be used.
1. Outlet boxes shall be no smaller than 4 inches square, and 2-1/2 inches deep.

2.2 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Black Box or equal.
- B. Description: Cat 6, 100-ohm, 4-pair UTP, shielded cable, covered with a blue thermoplastic jacket.
 1. Comply with ICEA S-90-661 for mechanical properties.
 2. Comply with TIA/EIA-568-B.1 for performance specifications.
 3. Comply with TIA/EIA-568-B.2, Category 6 for data.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.

2.3 UTP CABLE HARDWARE

- A. None required; cables terminated by others.

2.4 CONSOLIDATION POINTS

- A. None required; cables terminated by others.

2.5 MULTIUSER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

- A. None required; outlets by others.

2.6 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

2.7 IDENTIFICATION PRODUCTS

- A. Label each cable at each end my room and cable number.
- B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.8 SOURCE QUALITY CONTROL

- A. Factory test UTP cables on reels according to TIA/EIA-568-B.1.
- B. Factory test UTP cables according to TIA/EIA-568-B.2.
- C. Cable will be considered defective if it does not pass tests and inspections.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Provide two runs of 6-strand, single mode fiber from top of utility riser pole to ladder rack in I.T. Room (provide 25' coil at each end) for termination by others. Coordinate entrance fiber and cabling requirements with Owner.

3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and routed thru J-Hook/Bridle Ring System in accessible ceiling spaces. Conceal raceway and cables except in I.T. Room. All other areas shall utilize conduit system from workstation outlet to corridor cable management system.
 - 1. Install plenum rated cable in all areas, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

3.3 INSTALLATION OF PATHWAYS

- A. J-Hook/Bridle Ring System: Comply with TIA/EIA-569-A. Provide capacity for all new cabling to be installed plus 100% spare capacity. Provide tiered or tandem hooks as required.
- B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- C. Comply with requirements in Division 26 Section "Raceway and Boxes for Communications Systems" for installation of conduits and wireways. All low-voltage/communications cabling shall be installed in conduit within the Apparatus Bay, routed high to ceiling structure.
- D. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- E. Pathway Installation in Communications Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 2. Secure conduits to backboard when entering room from overhead.
 - 3. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
 - 4. Provide ladder rack spanning length of equipment room, running down the center of room or mount 12" above top of equipment racks. Coordinate rack locations with Owner.
 - 5. Install J-Hooks around perimeter of room near top of backboards 12" O.C.

3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. 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.
3. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
4. In the communications equipment room and at workstation outlet in private offices, install a 10-foot-long service loop on each end of cable. Locate private office service loop above accessible ceiling of office.
5. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable 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. Provide "J-hook" system throughout spaces with suspended acoustic ceiling system..

E. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data 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**.
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**.
4. Separation between communications cables in grounded metallic raceways and 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.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of **48 inches**.

3.5 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A
- B. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling
- C. 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. Exposed Cables: Label each cable at intervals not exceeding 15 feet.
 - 3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - 4. 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.
 - 5. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.
- D. Labels shall 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/EIA-606-A.
 - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.8 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Visually inspect UTP cable 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/EIA-568-B.1.
 - 2. Visually confirm Category 6 marking of outlets, cover plates, outlet/connectors, and patch panels.
 - 3. Visually inspect cable placement, cable termination, grounding and bonding and labeling of all components.

4. UTP Performance Tests:
 - a. No testing is required.

END OF SECTION 26 7561

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**SECTION 31 00 00
EARTHWORK**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Excavation for building slabs, walks and pavements.
- B. Filling and backfilling to attain indicated grade elevations.
- C. Rough and finish grading.
- D. Topsoil removed and stock piled.
- E. Granular backfill where indicated and specified.
- F. Topsoil spreading and Finishing.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 REFERENCES

- A. City of Dayton Construction and Material Specifications, (CMSD).
- B. State of Ohio Department of Transportation Construction and Material Specifications (ODOT), Latest Edition (2023), online version 01/09/2024

1.04 RELATED SECTIONS

- A. Section 31 10 00: Site Clearing.
- B. Section 31 22 19: Finish Grading.
- C. Section 31 23 33: Trenching, Backfilling and Compacting.

1.05 DEFINITIONS

- A. Excavation: Consists of removal of materials encountered to subgrade elevations indicated and subsequent disposal of materials removed.
- B. Subgrade: The compacted soil fill or undisturbed earth immediately below the footings, slabs or pavement systems.
- C. Sub base: The compacted granular fill layer used in pavement systems or buildings between the sub grade and the pavement base course material or building slab and foundation.

- D. Engineered Fill: This is a special fill placed under proposed pavement, building or other location in 6" lifts. Each lift compacted to ASTM698, 100% density under supervision of the Soil Engineer.

1.06 QUALITY ASSURANCE

- A. Perform work in compliance with applicable requirements of government authorities.
- B. Contractor shall retain and pay for an independent soil testing and inspection service during earth work operation. Rate of testing and inspection shall be as specified in Section 3.8 of the specification.

1.07 SUBMITTALS

- A. Submit the following for approval:
 - 1. Fill material imported
 - 2. Sub grade compaction report
 - 3. Foundation bearing condition report
 - 4. All compaction reports

1.08 JOB CONDITIONS

- A. Data indicated of subsurface conditions in the soil report are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn there from by Contractor. Data is made available for convenience of Contractor. However, note that the recommendations of earthwork given in the soil report are part of the contract documents. Contractor should verify job condition prior to bidding. This includes requirements of phasing, sequencing and protection of existing items to remain.
- B. Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.
- C. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of the utility owner.
- D. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by the Architect of Record and then only after acceptable temporary utility services have been provided.
- E. Provide minimum of 48-hour notice to the Architect of Record and receive written notice to proceed before interrupting any utility.
- F. Barricade open excavations occurring as part of this work and post with warning lights.
- G. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earth work operations.

- H. Conform to the sedimentation and erosion control requirements of the project and regulations of the authorities having jurisdiction.
- I. Conform to Section 31 25 00 Erosion and Sedimentation Control.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All backfill, fill, sub-base material and granular fill is subject to approval by the Architect of Record. Placement of these fill materials prior to approval is not acceptable and will result in unsuitable material being removed and replaced with approved fill at Contractor's expense.
- B. Suitable fill material not available at the site shall be imported from off-site subject to approval by the Architect of Record.
- C. Backfill and fill: Native soil materials free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter.
- D. Sub-base Material: Bank run sand and gravel less than 15% passing the 200 sieve.
- E. Granular fill and base: Conform to CMSD Item 703.04.
- F. Remove topsoil from the construction area and stockpile topsoil separately from other earth. Conform to CMSD Item 651.
- G. Topsoil: If quantity of stockpiled topsoil is insufficient, provide additional topsoil as required. New topsoil shall be fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter and free of roots, stumps, stones larger than 1/2" in any dimensions, and other extraneous or toxic matter harmful to plant growth.
- H. Filter Fabric shall conform to CMSD Item 712.09
- I. Control Density Fill Material, CDF - where indicated shall be Low Strength Mortar Backfill conforming to CMSD Item 615.
- J. Engineered Fill Material shall be site obtained soil or impaired soil weighing not less than 105 PCF at optimum moisture content - or as approved by the soil engineer - placed in 8" lifts - each lift compacted to 100% standard proctor.

PART 3 - EXECUTION

3.01 GENERAL

- A. Excavate for structures to elevations and grades shown. Extend excavation a sufficient distance from foundations to permit placing and removal of formwork, installation of materials, services and inspection.
- B. Excavate for sidewalks and paving to cross-sections, elevations and grades shown. Allow for base material.
- C. Hand trim footing and foundation excavations and leave free from loose organic matter.

- D. When complete, verify soil bearing capacities, depths and dimensions.
- E. Additional excavation shall be required when unsatisfactory soil materials extending below required sub grade elevations are discovered. All additional excavation shall be authorized, in writing, prior to performance of the work. Removal of unsuitable material and its replacement will be paid on basis of contract conditions relative to changes in work.
- F. Unauthorized excavation consists of removal of materials beyond indicated sub grade elevations without specific direction of the Architect of Record. Unauthorized excavation as well as remedial work directed by the Architect of Record shall be at Contractor's expense.
- G. Under footings, foundation bases, or retaining walls fill unauthorized excavation by extending indicated bottom elevation of footing base to excavation bottom, without altering required top elevation.
- H. Shore and brace excavations, as necessary, to prevent accidents or damage from caving or erosion. Remove shoring carefully to prevent caving or collapse of excavated faces.
- I. Maintain excavations free of water. Provide ample means and equipment to promptly remove and dispose of all water from every source entering excavations. Absorption of heavy rainfall accumulation of water and heavy construction traffic may result in softening of the soil; hence, severely weakening sub grade soils shear strength.
- J. Provide Filter Fabric where indicated. Conform to CMSD Item 712.09.

3.02 BACKFILLING AND FILLING

- A. Ensure areas to be backfilled are free from debris, snow, ice and water and that ground surfaces are not in a frozen condition.
- B. Do not backfill over existing sub grade which are porous, wet or spongy.
- C. Compact existing sub grade surfaces if densities are not equal to that required for backfill materials.
- D. Cut out soft areas of existing sub grade. Backfill with fill material and compact to required density.
- E. Spread approved fill material in layers not greater than 8" of un-compacted thickness. Do not use muddy or frozen fill materials.
- F. Moisture-condition fill material, as required, by aerating or watering and thoroughly mixes material to obtain moisture content permitting proper compaction.
- G. Compact each layer of fill material to at least the specified density requirement, repeat until plan grade elevation is attained.
- H. Use hand tampers or vibrating compactors at foundation walls and similar locations inaccessible to large equipment and rollers. Do not use rolling equipment adjacent to foundations.

- I. Do not backfill against building structures until walls or bearing surfaces have reached design strength or are properly braced and backfilling operations are approved.

3.03 FILL TYPES

- A. In building excavations: Existing foundation and basement areas: engineered fill or granular fill as indicated.
- B. Backfill basement and foundation walls: Granular fill and compacted subgrade.
- C. Under grassed and landscaped areas: Backfill and fill material.
- D. Under walks and pavements: Granular base on compacted subgrade or engineered fill.
- E. Granular backfill under all paved areas.
- F. CDF - where indicated.

3.04 COMPACTION

- A. Provide compaction control for all fill and backfill, both inside and outside perimeter of the structures. Perform field compaction tests and related laboratory analyses. Soil proposed for fill and backfill shall be analyzed by the Architect of Record. A representative of the testing laboratory shall provide continuous inspection during placement and compaction operations; tests shall be made in a quantity that will assure uniform compaction and density of each course, or lift of fill. The inspection and testing shall comply with the specifications set forth in Division 1. See Section 3.8 of the specification.
- B. Compact top 12" sub grade and each layer of fill or backfill material at foundations, within paved areas to a density of 98% of optimum, Standard Proctor dry density. The moisture in the cohesive site soils should be controlled within +/- 3% of the optimum Standard Proctor Moisture Content. Compact within the building area to 100% of optimum density.
- C. Compact top 6" of sub grade and each layer of fill or backfill material at lawns and unpaved areas to a density of 90% at optimum moisture content in accordance with ASTM D698, Standard Proctor Method.
- D. Puddling or jetting of fill and backfill material as a compaction method is not permitted.

3.05 GRADING

- A. Uniformly grade the site. Distribute stockpiled topsoil. Provide uniform levels and slopes. Grade areas to drain away from structures and prevent ponding. Provide surfaces free from irregular surface changes and as follows:
 1. Lawn areas: Provide 6" of topsoil at lawn areas. Finish grade to required finish grade elevations.
 2. Paving areas: Shape surface of areas to line, grade and cross-section, with finish surface not more than 1/2" above or below the required sub grade elevation.

3. Granular base: Grade surface smooth and even, free of voids and to within a tolerance of ½" of the required elevation.

3.06 MAINTENANCE

- A. Protect graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded and damaged areas.
- B. Where completed areas are disturbed by construction operations or adverse weather, scarify surface, reshape and compact to required density.
- C. Where settling is measurable or observable at excavation areas during general project warranty period, remove surface, add backfill material as specified, compact and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work.

3.07 EXCESS AND WASTE MATERIALS

- A. Remove waste materials, including rock, trash and debris from the site and legally dispose of it.
- B. Maintain disposal route clear, clean and free of debris.
- C. Remove excess excavated materials, including excess topsoil, from the site. Spread and grade as directed.

3.08 TESTING

- A. Quality control testing during construction: Allow testing service to inspect and approve sub grades and fill layers before further construction work is performed.
- B. If during progress of work, tests indicate that compacted materials do not meet specified requirements, remove defective work, replace and retest at no cost to the Owner.
- C. Paved Areas and Building Slab Sub grade: Make at least one field density test of sub grade for every 2,000 square feet of paved area or building slab, but in no case less than 3 tests. In each compacted fill layers, make one field density test for every 2,000 square feet of overlaying building slab or paved area, but in no case less than 3 tests.

END OF SECTION

**SECTION 31 10 00
SITE CLEARING**

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Remove surface debris.
- B. Remove paving, curbs, walls, retaining walls, steps, and miscellaneous other structures indicated on the drawings and as required for the construction of the project as detailed.
- C. Clear site of plant life and grass.
- D. Grub the site.
- E. Remove trees and shrubs within the work area.
- F. Remove root systems of trees and shrubs.
- G. Abandon/remove utilities.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 REFERENCES

- A. State of Ohio Department of Transportation Construction and Material Specifications (ODOT), Latest Edition (2016)

1.04 RELATED SECTIONS

- A. Section 31 00 00: Earthwork.
- B. Section 31 05 00: Erosion and Sedimentation Control

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable local codes for disposal of debris.
- C. Coordinate clearing work with utility authorities.

1.06 ENVIRONMENTAL CONDITIONS

- A. Conduct clearing to minimize interference with adjacent structures.
- B. Provide, erect, and maintain temporary barriers and security devices. Conduct operations with minimum interference to public or private thoroughfares. Maintain protected egress and access at all times.
- C. Do not close or obstruct roadways or sidewalks without permits.

PART 2 – PRODUCTS

- A. Not Used

PART 3 – EXECUTION

3.01 PREPARATION

- A. Verify that existing plant life and features designated to remain are tagged and identified.

3.02 PROTECTION

- A. Protect utilities and all other site features that remain, from damage.
- B. Protect trees, plant growth, and features designated to remain as final landscaping.
- C. Protect bench marks and survey monuments from damage or displacement.

3.03 CLEARING

- A. Clear areas required for access to site and execution of work.
- B. Remove paving and curbs. Saw cut pavement or carefully remove at nearest joint.
- C. Remove boundary walls, retaining walls, steps, debris, drainage gutters, and all other items interfering with construction within the limits shown on the drawings.
- D. Remove trees and shrubs complete within the limits shown on the drawings including stumps and all roots.
- E. Grub all areas within limits of construction, including areas under new fill, to a depth of 2 inches, removing all sod.
- F. Conform to all applicable requirements of ODOT Item 201.

3.04 REMOVAL

- A. Entire site shall be cleared of all debris such as dumped excavated materials, stones, broken concrete, asphalt, lumber, trash, etc.
- B. All materials removed during clearing and grubbing operations shall be immediately removed from the site and disposed of legally. OARDC does not permit excavated materials to be removed from its campus. A designated stockpile area for these materials is located within one mile of the project site.
- C. Burning or burying of materials on the site will not be permitted.

END OF SECTION 31 10 00

SECTION 312219 - FINISH GRADING

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This work shall consist of placing and leveling topsoil materials to the grades and lines specified on the plans.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 REFERENCES

- A. City of Dayton Construction and Material Specifications (CMSD)
- B. State of Ohio Department of Transportation Construction and Material Specifications (ODOT), Latest Edition (2023), online version 01/09/2024

1.04 RELATED SECTIONS

- A. Section 31 00 00: Earthwork.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.01 INSPECTION

- A. Verify site conditions and note irregularities affecting work of this Section.
- B. Beginning work of this Section means acceptance of existing conditions.

3.02 SUBSOIL PREPARATION

- A. Remove debris, roots, branches, stones in excess of ½ inch in size.
- B. Remove subsoil contaminated with petroleum products.
- C. Scarify sub grade to depth of 3 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.03 PLACING TOPSOIL

- A. Place topsoil in areas where seeding is scheduled to a depth of 6 inches and 6 inches in areas shown as plans as planting beds.
- B. Use topsoil in relatively dry state. Place during dry weather.

- C. Fine grade topsoil eliminating rough areas. Maintain levels, profiles, and contours specified on the plans.
- D. Remove stone, roots, grass, weeds, debris and foreign materials in excess of 1 ½ inches in size while spreading.
- E. Lightly compact placed topsoil.
- F. Remove surplus subsoil and topsoil from site.
- G. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.04 TOLERANCES

- A. Top of topsoil; plus or minus ½ inch.

END OF SECTION

**SECTION 312333
TRENCHING BACKFILLING AND COMPACTING**

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This work shall consist of excavating the trench, backfilling the trench after pipe installation, and compaction of designated areas. The work shall be performed by contractors normally engaged in excavation, having the experienced personnel to perform work of the type required by the Contract Documents for this project, and licensed where appropriate.
- B. Provide all labor, equipment and material to complete the construction proposed on the drawings and as specified.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 REFERENCES

- A. City of Dayton Construction and Material Specifications (CMSD)
- B. State of Ohio Department of Transportation Construction and Material Specifications (ODOT), Latest Edition (2023), online version 01/09/2024

1.04 RELATED SECTIONS

- A. Section 31 00 00: Earthwork.

1.05 SUBSURFACE DATA

- A. Subsurface soil investigations have been made at the site. The complete report of information obtained may be examined in the offices of the Architect of record.
- B. Bidders and Contractors are expected to examine the site and review the soil report, determine the character of materials to be encountered and requirements of construction of the project prior to bidding. No additional borings are required during bidding.

1.06 PREPARATION AND PROTECTIONS

- A. Protect and maintain benchmarks, monuments, batter boards, or other reference points from displacement or damage. Immediately replace or repair reference points damaged, destroyed or displaced to condition approved by Architect of Record.
- B. Verify locations of active utility lines and sewers, including manholes, within and adjacent to project site. Use caution in all earthwork operations in these areas to avoid displacement or

damage to such items. Support and protect such lines with suitable measures as required including use of temporary sheet piling, shoring, etc., as necessary.

- C. Shore and brace ground areas and cut-slopes adjacent to excavated areas as necessary to maintain stability of the unexcavated areas and to prevent cave-ins. Do not remove temporary protection until adequate permanent support is provided.
- D. Protect bottom of excavations from frost and surface drainage. If freezing occurs, remove frozen soil and replace with approved compacted fill or backfill material (granular material or lean concrete) as approved by the Architect of Record for the conditions.
- E. Keep the excavations free from water. Use pumps as necessary. Conduct removed water to approved collecting or runoff areas outside the limits of all proposed excavation.
- F. Protect newly backfilled areas as necessary from actions of the weather elements. Any settlement or washing that occurs shall be repaired and grades reestablished by Contractor at no additional cost to the University.

1.07 DRAINAGE MAINTENANCE

- A. During entire course of earthwork operations and other work, the Contractor is responsible for and required to maintain in functional condition all existing drainage ways, including into, around and from the project areas.
- B. In addition, provide any temporary measures necessary to assure proper drainage on the project site area and maintain function.

1.08 DISPOSAL OF WASTE AND EXCESS MATERIALS

- A. Remove from site and legally dispose of all materials encountered that are unsuitable for incorporation into project work, and spread all excess materials from earthwork operations evenly east of the proposed building.
- B. No burying or burning of waste materials is permitted on site.

PART 2 – PRODUCTS

2.01 PRODUCTS

- A. Bedding: #57 stone conforming to ODOT Item 703.
- B. Bedding: #8 stone conforming to ODOT Item 703.

PART 3 – EXECUTION

3.01 TRENCHING

- A. Safety:

4165.00

TRENCHING, BACKFILLING AND
COMPACTING

312333-2

1. For the security or safety of persons in and adjacent to trenches or construction operations, the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America as well as the pertinent specifications of the Occupational Safety and Health Act, with all current amendments shall be followed when specifically applicable, or by similarity of operation or as necessary for adequate protection.

3.02 PROTECTION OF TREES

- A. Special care shall be taken to avoid damages to trees and their root systems. Machine excavation shall not be used when it would endanger tree roots. In general, where the line of trench falls within the limits of the limb spread, the leaving of headers across the trench to protect roots will be required. The operation of all equipment, particularly when employing booms, the storage of materials, and the deposition of excavation, shall be conducted in the manner which will not injure trees, trunks, branches or their roots unless such trees are designated by the Architect of Record for removal.
- B. Site construction fence required around existing oak tree to remain as indicated.

3.03 TRENCH EXCAVATION (Earth)

- A. The trenches in which the pipes and appurtenances are to be constructed shall be excavated in all cases in such a manner and to such widths as will accommodate the building of the structures they are to contain. In no case shall the trench width at the top of the pipe exceed the outside diameter of the pipe plus eighteen (18) inches for pipe up to 24 inches I.D.; plus thirty-six (36) inches for pipe from 27 inches to 72 inches I.D.; plus forty-eight (48) inches for pipe greater than 79 inches I.D... Machine excavation shall be stopped at the depths outlined under "Bottom Preparation" for the type of pipe being installed. Unauthorized excavation below grade shall be filled with granular material, at the expense of the Contractor.
- B. Width of trenches shall be held to a minimum to accommodate the pipe, timbering, etc., and in no event will the trench width at the top of the pipe diameters be less than specified in the Trench Excavation (Earth) Section 4, unless prior approval has been received from the Architect of Record.
- C. If for any reason, excessive trench width occurs at depth which would impose critical loads on the pipe, the Contractor shall provide gravel or stone backup, extra strength pipe or concrete encasement as approved by the Architect of Record at no additional cost to the Owner.
- D. Where the pipe is located adjacent to, or in pavement, the Contractor shall be required to maintain vertical sides on all trenches using full sheeting and bracing if necessary. Maximum top width of trench permitted under such conditions shall be four (4) feet, plus the inside diameter of the pipe.

3.04 BOTTOM PREPARATION

4165.00

TRENCHING, BACKFILLING AND
COMPACTING

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- A. The trench shall be machine excavated to a point not less than six (6) inches below the barrel of the pipe. All loose earth shall be removed from the trench bottom and a bed prepared and compacted using bedding material according to the Section titled "Bedding and Haunching."

3.05 FOUNDATION

- A. The sewers or other utility mains are to be built on good foundation. Such measures as necessary and as approved by the Architect of Record shall be used to prevent settlement. If, in the Architect of Record's opinion, the material forming the bottom at the grade of the sewer or pressure main is not suitable for foundation, a further depth shall be excavated and the same filled with granular material and compacted. Contact price shall be adjusted accordingly for additional excavation and backfill.

3.06 DRAINAGE

- A. Should water be encountered, the Contractor shall furnish and operate a suitable pumping plant with a capacity adequate to de-water the trench, dispose of such water, and to maintain drainage conditions, as approved by the Architect of Record. During laying and joint making operations, the water level in the working area shall be maintained at an elevation of at least two (2) inches below the bottom of the bell of the pipe until, in the opinion of the Architect of Record, water damage to completed joints will not occur.

3.07 TIMBERING

- A. Unsupported open cut for sewers will not be permitted to occur where in violation of the Occupational Safety and Health Act of 1970, and its revisions, or where soil conditions necessitate unusually wide trenches causing damage to street pavement, trees, structures, poles, or other private or public property. During the progress of the work, whenever and wherever it is necessary either to provide safe working conditions or to avoid the danger of damage to existing structures or structures being built, the Contractor shall, at his expense, support the sides of the excavation by adequate and suitable sheeting, shoring and bracing. Such trench support material and equipment shall remain in place until backfilling operations have progressed to the point where the supports may be withdrawn without endangering structures.

3.08 TRIMMING

- A. All material excavated in trenching and all materials used in construction of the work shall be deposited so as not to endanger the work or create unnecessary annoyance to the public. During the progress of the work, all material piles shall be kept trimmed and maintained in a neat, workmanlike manner.

3.09 BEDDING AND HAUNCHING

- A. Pipe Bedding Materials per CMSD Item 810.02

- B. To assure adequate and uniform support of the pipe, a bedding layer 6" min. or O.D./8 (whichever is larger) in depth shall be provided. Required Bedding Classes for different pipe materials are listed in the following table:
- C. The same material used for bedding shall be used for haunching to the spring line of the pipe (horizontal center line). Class I material requires slight compacting. Precautions shall be taken to prevent movement of the pipe during placement of the haunching.

3.010 INITIAL BACKFILL

- A. The same material used for bedding and haunching shall be placed to a minimum depth of six (6) inches over the pipe. This shall be increased to twelve (12) inches over the pipe if remaining backfill material contains large or heavy particles that may damage the pipe.

3.011 TRENCH BACKFILLING

A. Description

1. All trenches and excavations shall be backfilled immediately after pipe is laid and/or tested. No material shall be used for backfilling that contains stones, having a dimension greater than three (3) inches, frozen earth, debris, or earth with an exceptionally high void content.
2. For backfill above the horizontal centerline and to a level of 6" to 12" over the top of the pipe, bedding materials shall be used, and placed as previously described. Each layer shall be placed, then carefully and uniformly tamped, so as to eliminate the possibility of pipe settlement, misalignment and damage to joints. In lieu of the above described method the Contractor may, at his own expense, use shovel tamped granular material to backfill over the pipe. The Contractor shall place bulkheads of native clay soil across the trench at 100 foot intervals to resist the movement of groundwater through the granular material. Such bulkheads shall be carefully compacted and shall extend approximately three feet in a direction parallel to the pipe and shall extend from the bottom of the trench to a height of 12 inches above the top of the pipe.
3. Above the tamped backfill, the Contractor may complete the backfilling with mechanical equipment. This shall be done in such a manner that the material does not free-fall onto the hand-placed cover. The backfill shall be so placed that it will "flow" onto the hand-placed cover from the section partially filled. The Contractor shall consolidate the backfill in such a manner as will insure the minimum possible settlement at the least interference with traffic. Where sewers are located in or adjacent to pavements, all backfilling and materials handling equipment shall have rubber tires. Through rights-of-ways, not adjacent to pavement areas, "crawler" type backfill equipment will be permitted. Granular material shall be used for backfill of trenches in pavements and driveways and at other places where indicated. The granular backfill shall be as specified under Section 3.14 "Granular Backfill." Periodical dressing of fill over the trench to improve drainage and safety conditions shall be made during the course of the contract.

B. Noise, Dust and Odor Control

1. The Contractor's performance of this contract shall be conducted so as to eliminate all unnecessary noise, dust and odors.

C. Cleaning Up

1. Immediately after a section of pipe is tested and accepted for payment, the ground surfaces shall be cleaned of all surplus material including stones, broken pipe, construction material, and all other debris by the Contractor, to the satisfaction of the Architect of Record.
2. The Contractor shall be responsible for the condition of the trenches for a period of one year from the date of the contract completion.

D. Minimum cover backfill requirements:

Paved within ROW	48 inches or Less	Concrete Encasement
	Greater than 48 inches	Structural Backfill per CMSD Item 813
Paved	30 inches or Less	Concrete Encasement
	Greater than 30 inches	Structural Backfill per CMSD Item 813
Unpaved	24 inch or 1 pipe diameter Minimum (the greater)	Compacted Backfill per CMSD Item 810
*Note 1: Cover equals the distance from top of pipe to proposed grade or top of pavement elevation.		

3.012 GRANULAR BACKFILL

A. Description

1. Where specified by the Architect of Record, the excavation shall be backfilled with granular material so placed and compacted as to prevent further settlement.
2. Granular material shall be as indicated in Section 31 00 00 - Earthwork
3. Granular material shall be placed in layers of approximately six (6) inches in thickness and compacted with mechanical tampers. It may be compacted with water if satisfactory drainage is provided for the free water.

3.013 RESTORATION OF EXISTING SURFACES

A. Lawns

1. The area shall be covered with at least four (6) inches of topsoil (stripped and saved from the trench excavation or borrow) and brought level with surrounding ground.
2. The area shall be hand raked and shall be free of rock and foreign material greater than one (1) inch in any dimension.

B. Field areas

4165.00

TRENCHING, BACKFILLING AND
COMPACTING

312333-6

1. Upon completion of construction, soil shall be mounded over any pipeline trench to a height of 18 inches above existing ground elevation. After sufficient rainfall has occurred to insure 90% settlement, the area shall be brought to level grade by removing, or adding additional earth, as conditions warrant.

3.014 PAVEMENT REPLACEMENT OVER TRENCHES

- A. All existing pavement surfaces, other than those for which resurfacing has been provided, shall be restored to their condition at the time the project was begun, by filling all gouges or other damages with the equivalent material for asphalt surfaces, and a vinyl, or epoxy concrete approved by the Architect of Record for existing Portland Cement Pavement.

3.015 EROSION AND SEDIMENT CONTROL MEASURES

- A. The Contractor shall prevent and control all problems associated with erosion and sediment runoff processes which occur during and after project construction. The Contractor shall comply with all applicable federal, state and local laws, and particularly the Environmental Protection Agency Nonpoint Source Pollution Control Guidance.
- B. Site construction shall consider potential occurrence of erosion and sediment losses. Study of the site conditions should include soil and geologic limitations, topography, vegetation, wildlife habitats, proximity to surface water, and climate.
- C. The construction layout, sequencing and scheduling shall be designed to fit the local topography and soil conditions.
- D. Whenever feasible, land grading and excavating shall be kept at a minimum to reduce the possibility of creating runoff and erosion problems that require extensive control measures.
- E. Topsoil shall be removed and stockpiled before grading begins.
- F. Land exposure shall be minimized in terms of area and time.
- G. Exposed areas, subject to erosion, shall be covered as quickly as possible by means of mulching or vegetation.
- H. Natural vegetation shall be retained whenever feasible.
- I. Appropriate structural or agronomic practices to control runoff and sedimentation shall be provided during and after construction.

3.016 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D698 and Division 1.

- C. Compaction testing will be performed in accordance with ASTM D2922 and ASTM D3017 and with Division 1.
- D. If tests indicate Work does not meet specified requirements, remove work, replace, and retest at no cost to Owner.
- E. Frequency of Tests: Every two lifts.

END OF SECTION

**SECTION 32 11 00
BASE COURSES**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This work shall consist of furnishing, placing and compacting one or more courses of aggregate, including furnishing and incorporating all water required for compacting, on a prepared surface in accordance with these specifications, in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans.
- B. This work shall consist of inspecting and testing previously placed and compacted aggregate by others in accordance with these specifications, and regrading, furnishing, placing and compacting one or more courses of aggregate, including furnishing and incorporating all water required for compacting, on previously placed and compacted aggregate by others in accordance with these specifications, in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 REFERENCES

- C. City of Dayton Construction and Material Specifications (CMSD)
- D. Ohio Department of Transportation Construction and Material Specifications (ODOT), Latest Edition (2023), online version 01/19/2024.
- E. State of Ohio Department of Transportation Construction Administration Manual of Procedures
- F. State of Ohio Department of Transportation Supplement 1015 Compaction Testing of Unbound Materials.

1.04 RELATED SECTIONS

- G. Section 31 00 00: Earthwork
- H. Section 32 12 16: Asphaltic Paving

PART 2 - PRODUCTS

2.01 AGGREGAE BASE

- A. The aggregate base shall be ODOT Item 304 as a minimum. Additionally, conform to the following:
 - 1. The aggregate shall be crushed carbonate stone, crushed gravel, crushed air-cooled slag, slags or slacker aggregate. Crushed carbonate stone, crushed gravel, crushed air-cooled slag or mixtures of crushed and granulated slags shall meet the following

gradation requirements as well as 50 percent wear maximum, by the Los Angeles Test (stone or gravel); 25 percent maximum loss, sodium sulfate soundness test; and no more than 90% maximum of fractured pieces. Shale shall not exceed 5 percent.

Sieve Size	Total Percent Passing
2 inch	100
1 inch	70-100
¾ Inch	50-90
No.4	30-60
No.40	7-30
No.200	0-13

- B. Aggregate acceptance shall be determined prior to incorporation into the work based on sample taken from stockpiles.
- C. Prior to placing, aggregate shall have reasonably uniform moisture content at or near optimum for compaction.
- D. Stone greater than 2 1/2 inches shall be excluded from the course.

PART 3 - EXECUTION

3.01 AGGREGATE

- A. As a minimum conform to ODOT item 304. Additionally, conform to the following:
 - 1. Placing
 - a. When vibratory equipment is used in conjunction with other methods of compaction, the depth of a single layer shall not exceed 6". When vibratory compaction equipment is not used, the maximum compacted thickness of one layer shall not exceed 3 inches. When the required compacted depth of the base course exceeds 6 inches, the base shall be constructed in two or more layers of approximately equal thickness.
 - 1) The aggregate shall be placed with self-propelled spreading machines capable of placing the aggregate true to line and grade. Approved hand placing methods may be used when the total area of base course is 2,000 square yards or less, or in small areas where machine spreading is impractical.
 - 2) Unless the base course is placed in a trench section, the edges shall be backed up with an 18-inch width of soil, placed to such a height that it will be consolidated to the height of the lift being compacted and furnish positive lateral support during compaction.
 - 3) Adequate surface drainage of the berm shall be provided at all time.
 - 2. Compaction
 - a. At the beginning of the compaction operation, the density requirement shall be determined by compacting a short section, until no further increase in density is obtained. The remainder of the course shall be compacted to a density not less than 98 percent of the test density. A new density requirement may be determined when the aggregate characteristics change appreciably. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture is produced and the aggregates firmly keyed. Water shall be uniformly applied over the base materials during compaction in the amount necessary to maintain the moisture at or near optimum.

- b. The Contractor shall perform all compaction tests according to ODOT Supplement 1015. At a minimum, compaction testing shall be performed every 2,000 sf.
 - c. The finished surface shall not vary more than 3/8 inch from a 10-foot straightedge parallel to the centerline nor more than 1/2 inch from a template conforming to the required cross section. The Contractor shall furnish straight edges, templates or other devices and check the surface for conformance with these requirements.
- 3. WIDTH
 - 1) Width of the base course shall be greater than or equal to the width of pavement surface, if continues lateral support is provided during rolling, and shall extend two (2) times (x) base thickness beyond the edge of the course above, if not laterally supported.

END OF SECTION

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**SECTION 32 13 13
WALKS**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This work shall consist of construction of walks and curb ramps of specified materials in conformity with lines, grades, and dimensions shown on the plans.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 RELATED SECTIONS

- A. 32 12 16: Asphalt Paving.
- B. 31 00 00: Earthwork.

1.04 REFERENCES

- A. City of Dayton Construction and Material Specifications (CMSD), Latest Edition (2020).

PART 2 – PRODUCTS

2.01 MATERIALS

- A. All materials used in the concrete mixture, the proportioning and mixing shall conform to CMSD Item 499 Class D concrete and CMSD Item 608.
- B. Expansion joint material: CMSD Item 705.03

PART 3 – EXECUTION

3.01 As a minimum, conform to CMSD Item 608. Additionally, conform to the following:

- A. Excavation shall be made to the required depth and to a width that will permit the installation and bracing of forms. The sub grade shall be shaped and compacted to meet the requirements of Section 31 00 00: Earthwork.
- B. Forms shall be of wood or metal and extend for the full depth of the concrete, and of sufficient strength to resist the pressure of the concrete without springing.

3.02 PLACING AND FINISHING

- A. The sub-grade shall be moistened thoroughly immediately prior to placing concrete. The concrete shall be deposited in a single layer. It shall be struck off with a template and smoothed with a wood float or fine broom to obtain a sandy texture. No plastering will be permitted. All outside edges and joints shall be edged with a ¼ inch radius-edging tool. The surface of the walks shall be divided into blocks by grooves equally spaced at approximately five-foot intervals, to form rectangular blocks. Expansion joints shall be formed around all appurtenances such as manholes or utility poles extending into and through the sidewalk.
- B. Transverse expansion joint strips ½ inch in thickness and extending the full depth of the walk shall be placed at intervals of 20 feet. Expansion joint strips at least ½ inch in thickness shall also be installed between the junction of the walk with all curbs and any fixed structures, extending the full depth of the walk unless otherwise specified on the plans.
- C. The surface of the walk shall have a transverse slope of 1/4 inch per foot, with the low side adjacent to the roadway.
- D. Provide turned-down edge where indicated.

END OF SECTION

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**SECTION 32 16 13.16
CAST-IN-PLACE CONCRETE CURBS**

PART 1 GENERAL

1.01 WORK INCLUDED:

- A. The following in general describes the work included in this section:
 - 1. Concrete curb constructed close to conformity with line, grades and cross-section shown on the drawing.
- B. Excavation and backfill
- C. Joints and sealant
- D. Curb cuts and curb ramps

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 RELATED SECTIONS

- A. Section 31 00 00: Earthwork
- B. Section 32 12 16: Asphalt Paving
- C. Section 32 13 13: Walks

1.04 REFERENCES

- A. City of Dayton Construction and Material Specifications (CMSD), (Latest Edition).

PART 2 PRODUCTS

2.01 MATERIALS

- A. Class D concrete in accordance with Item 451 and 499 and the ratio and size of aggregate shall be ordered to secure a workable mix
- B. Bituminous joint sealer per Item 705.04 or 705.11
- C. Expansion joint material per Item 705.03.
- D. City of Dayton Concrete Barrier Curb per STD DWG 8/45

2.02 SUBMITTALS

- A. Submit mix design for approval.

PART 3 EXECUTIONS

- 3.01** The installation requirement shall be in accordance with CMSD Item 609 as a minimum. Additionally, conform to the following:

- A. Forms and Joints
 - 1. Curb forms shall be approved metal forms. They shall be securely braced and held to line and grade specified. The inner surface of the forms shall be clean and coated with suitable oil immediately before the concrete is placed.
 - 2. All curb not constructed integral with the base or pavement shall have ¼ inch contraction joints constructed at 10-foot intervals. The joint may be constructed with

the use of metal separator plates, by the use of a grooving tool, or sawed in accordance with CMSD Item 451. The depth of joint for curb shall average 15% or more of the curb height. The bottom of the saw kerf shall slope to the pavement for curb. The joint shall be filled with joint sealer. Where expansion joints occur in the abutting pavement, they shall be provided for by separation of the section being placed with 1 inch preformed joint filler.

3. When the curb is integral with the base of pavement, joints of the type used in the pavement shall be constructed in the curb except that if the pavement joints are filled with CMSD Item 705 material, any type may be used. The curb joints shall be spaced identically with the joints in the base or pavement.
 4. Curb forms shall be left in place for such length of time that the removal of same does not crack, shatter or otherwise injure the concrete.
 5. Where the curbs built under this item are to later serve as a support for a finishing machine in the placing of a surface course, the alignment of the supporting edges shall be such that the distance between the curbs shall nowhere vary more than 1/2 inch from that specified.
 6. Approved flexible forms of steel or wood may be used for construction of circular curb where radius is 200 feet, or less.
- B. Placing
1. The concrete shall be placed in the forms, prepared as above described, in layers thin enough to permit thorough spading. It shall be spaded in such a manner as to eliminate all voids. Provide internal mechanical vibration during placement.
 2. Concrete for curb which is to be integral with the concrete base or pavement shall be placed while the concrete is plastic, except when the presence of finishing equipment on the forms at the end of the day's run makes this impossible. When this condition prevails 5/8 inch round deformed rods shall be placed vertically in the pavement at one-foot intervals and in a line 3 inches inside of and parallel to the edge forms. These rods shall extend to within 1-1/2 inches of the sub grade or sub base and 2 inches above the pavement surface when placed. Immediately before the concrete curb is placed, the surface of the pavement or base on which the concrete curb is to be placed shall be flushed with mortar which contains one part cement to two parts sand. The mortar shall be worked into the surface cavities by brushing.
- C. Curb Machine
1. Concrete curb may be placed with a self-propelled machine. The proper density and cross section shall be obtained by forcing the concrete through a mold of the proper cross section. Where a track is used, the track on which the machine operates shall be set and held to the exact line and grade given on the plans. The concrete shall be of such consistency that it can be molded into the desired shape and then will remain as placed without slumping of the vertical faces.
- D. Finishing
1. The top of the curb shall be floated in such a manner to thoroughly compact the concrete and produce a smooth and even surface. The addition of extra mortar to secure this result will not be permitted. The edge of the curb shall be rounded by the use of a tool especially designed for the purpose. The exposed face of the curb shall be rubbed with a float immediately after removing the forms. Unnecessary tool marks shall be eliminated. The finished surface shall be free of irregularities and waves and shall be uniform in texture. Provide light broom finish.
- E. Protection
1. Concrete curb shall be cured in accordance with CMSD Item 609 except that membrane cure shall be applied at a rate of not less than 1 gallon per 200 square feet of surface.
 2. Use white-pigmented liquid membrane curing compound.

3.02 ACCEPTANCE CRITERIA

- A. The curb grade profile shall be in conformance to the contract document. The maximum variation allowed is 1/8" per 10 feet.

END OF SECTION

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**SECTION 32 17 23
PAVEMENT MARKINGS**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This work shall consist of furnishing and applying retro-reflective pavement marking materials in accordance with the lines and dimensions shown on the plans or as described herein. All pavement markings shall conform with the requirements of the "Ohio Manual of Uniform Traffic Control Devices for Streets and Highways".

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 RELATED SECTIONS

- A. 321216: Asphalt Paving

1.04 REFERENCES

- A. City of Dayton Construction and Material Specifications (CMSD) (latest edition)
- B. Ohio Department of Transportation Construction and Material Specifications (ODOT), Latest Edition (2023), online version 01/06/2024.

1.05 QUALITY ASSURANCE

- A. Pavement markings shall be free of uneven edges, over-spray, or other readily visible defects which, in the opinion of the Associate Architect, detract from the appearance or function of the pavement markings. Methods and equipment used for pavement preparation, marking, and marking removal shall be subject to the approval of the Associate Architect.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. The traffic paint shall be of a formulation, identified by a code number, prequalified by the Laboratory and shall have the same composition as the paint of the code number approved by prequalification.
- B. Traffic Paint:
 - 1. Traffic Paint per CMSD Item 740.02
 - 2. Glass Beads, Type A per CMSD Item 740.09

C. Thermoplastic Pavement Marking:

1. Thermoplastic pavement marking per CMSD Item 740.04
2. Glass beads, Type C per CMSD Item 740.09

PART 3 - EXECUTION

3.01 PAVEMENT PREPARATION

- A. The Contractor shall clean all visible loose or foreign material from the surface to be marked. The Contractor shall power broom clean all surfaces where gore markings or edge lines are to be applied. Portland cement concrete painting shall not be done until the concrete in the areas to be painted is clean of membrane curing material and in a dry condition necessary for painting.

3.02 PAINT APPLICATION

- A. The Contractor shall transfer the entire contents of each paint container to the striper tank. Pavement marking materials shall be applied uniformly to the surface to be marked. The paint shall be thoroughly mixed at all times during application. Thinning shall not be permitted. Pavement markings shall be applied only when the surface is clean and dry, and when the temperature of the surface is above 40 F. Construction work such as shoulder paving, seeding and mulching shall be scheduled and performed in a manner to avoid damage to applied pavement markings.
- B. Lines shall be applied as solid, dashed or dotted stripes, either singly or in combination, as shown on the plans. Dashed lines shall be applied in a 40-foot cycle consisting of a 10-foot dash and a 30-foot gap between dashes, unless otherwise shown on the plans. Dashed lines, which are to be applied over plainly visible existing dashed lines, shall begin within 6 inches of the beginning of the existing dash, unless otherwise directed by the Associate Architect. Dotted lines shall be applied in a 6-foot cycle consisting of a 2-foot dot and a 4-foot gap between dots.
- C. Paint shall be applied at the following rates:

	Gallons per Mile Line				
Width of Line, In.	4	6	8	12	24
Solid Line	16	24	32	48	96
Dashed Line	4	6	-	-	-
Dotted Line	5 1/3	8	-	-	-

- D. When paint is applied to new bituminous pavement surfaces, the specified application rate shall be increased 25 percent.
- E. Glass beads shall be applied to the wet paint so that the beads are embedded and retained in the paint and uniformly covers the paint surface. The rate of application shall be not less than 6 pounds of glass beads per gallons of paint applied.
- F. The temperature of fast dry paint at the discharge point shall be in the range of 140-170F.
- G. Lines shall be sharp, well defined, and retro-reflective. The width of line applied shall be the width specified plus or minus ¼ inch. Fuzzy lines, excessive over-spray, or non-uniform application is unacceptable. Lines will be inspected at night to verify proper

retro-reflectivity. Pavement markings that are improperly applied, improperly located, or non-retro-reflective shall be corrected. Lines applied with insufficient material quantities shall be properly reapplied or shall be subject to acceptance with deduction as provided in CMSD Item 642. Improperly located lines shall be removed by a method approved by the Engineer and lines shall be applied in the correct locations at the Contractor's expense, including the furnishing of approved materials.

3.03 THERMOPLASTIC APPLICATION

- A. Application shall be per CMSD Item 644

3.04 LAYOUT AND PREMARKING

- A. The Contractor shall lay out the locations of all lines, words and other symbols to assure their proper placement. When applying longitudinal or transverse lines, the Contractor shall use existing lines, construction joints or pre-marking to guide his marking equipment.
- B. On projects where resurfacing or other operations will result in obliteration of the existing pavement markings, the Contractor shall establish reference points to assure proper placement of restored markings.
- C. "T" marking of no-passing zones shall be established by the Contractor in accordance with the contract plans or a no-passing zone log provided by the Associate Architect.
- D. Pre-marking shall be located from survey data or reference points and offset so as to parallel the theoretical edge of the marking lines at a maximum distance of one inch. Templates are required for the layout of arrows, words and other symbols.
- E. Pre-marking for longitudinal lines shall be placed at 40-foot intervals and shall not exceed 2 inches in width or 12 inches in length.
- F. The layout and pre-marking lines shall be approved by the Associate Architect before marking operations are started.

3.05 LINE PLACEMENT TOLERANCE

- A. Pavement marking lines shall be straight or smoothly curved, true to the alignment of the pavement, and shall not deviate laterally from the proper location at a rate of more than 2 inches in 100 feet. No deviation greater than 3 inches will be permitted.

3.06 EDGE LINES

- A. Lane line shall be 4-inch wide retro-reflective thermoplastic stripes offset six inches from the edge of pavement.

3.07 CENTER LINES

- A. Center lines shall be single yellow retro-reflective thermoplastic stripe between contiguous lanes of pavement carrying traffic in opposite directions. Each stripe shall be 6 inches wide, dashed.

3.08 PARKING LOTS STALL MARKINGS

- A. Parking lot stall marking lines shall be continuous yellow painted stripes, 4 inches in width.

3.09 SYMBOL ON PAVEMENT

- A. Symbols on pavement shall be retro-reflective painted yellow markings. Paint shall be applied at the rate of 1 gallon to each 100 square feet.

3.010 SPECIAL REQUIREMENT

- A. All painted pavement markings applied to new asphalt pavement are to be re-applied after one year.

END OF SECTION

SECTION 32 9113 - LANDSCAPE GRADING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Final grade topsoil for finish landscaping.

1.2 RELATED SECTIONS

- A. Section 31 0000 - Earthwork.
- B. Section 32 9200 - Turf and Grasses.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Topsoil: Provide Topsoil as specified in Specification Section 31 2000 - Earth Moving.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that building and trench backfilling have been inspected.
- B. Verify that substrate base has been contoured and compacted.

3.2 SUBSTRATE PREPARATION

- A. Eliminate uneven areas and low spots.
- B. Remove debris, roots, branches, stones, in excess of ½ inch in size.
- C. Scarify surface to depth of 6 inches (150 mm) where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.3 PLACING TOPSOIL

- A. Place topsoil in areas where seeding and planting is required to thickness as scheduled.
- B. Place topsoil during dry weather.
- C. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.
- D. Remove roots, weeds, rocks, and foreign material while spreading.
- E. Manually spread topsoil close to existing plant life and building to prevent damage.
- F. Lightly compact placed topsoil.
- G. Surplus imported subsoil and topsoil shall be removed from the Owner's property.
- H. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.4 TOLERANCES

- A. Top of Topsoil: Plus or minus ½ inch.

3.5 PROTECTION

- A. Protect landscaping and other features remaining as final work.
- B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.

3.6 SCHEDULES

- A. Compacted topsoil thickness at the following areas:
 - 1. Lawn: 4 inches.
 - 2. Landscape Beds: 8 inches.

END OF SECTION

SECTION 32 9200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Seeding, optional Hydroseeding, mulching, and fertilizing.
- B. Maintenance.

1.2 RELATED SECTIONS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.
- B. Section 31 0000 Earthwork.
- C. Section 32 9113 Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this Section.
- D. Section 32 9300 Trees, Plants, and Groundcover
- E. Section 31 22 19: Finish Grading.

1.3 DESCRIPTION

- A. All disturbed areas not covered by Building and Pavement or Landscaping shall be seeded as specified herein

1.3 REFERENCES

- A. ASPA (American Sod Producers Association) - Guideline Specifications to Sodding.
- B. FS O-F-241 - Fertilizers, Mixed, Commercial.
- C. City of Dayton Construction and Material Specifications, (CMSD).

1.4 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.5 SUBMITTALS

- A. Submit under provisions of Specification Section 01 7700 Closeout Procedures.
- B. Maintenance Data: Submit maintenance instructions, recommended cutting methods and maximum grass height, types, application frequency, and recommended coverage of fertilizer.

- C. Product Data: Submit seed vendors' certified statement for grass seed mixture required, stating botanical and common names, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species.
- D. Certificate of Compliance: See Regulatory requirements.

1.6 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.7 REGULATORY REQUIREMENTS AND JOB CONDITIONS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- A. Provide certificate of compliance from Project Manager indicating approval of seed mixture.
- B. The areas to be seeded under this item shall include all areas disturbed within the right-of-way lines. All areas outside of the specified limits where the vegetative growth has been injuriously disturbed or destroyed by the Contractor shall be restored and seeded in accordance with these specifications, by the Contractor at his expense.
- C. Commercial fertilizers shall be obtained by the Contractor from a dealer or manufacturer whose brands and grades are registered or licensed by the State of Ohio, Department of Agriculture.
- D. All seed and fertilizer shall be stored in a dry location and be protected from freezing.
- E. All seeding is to be done March 15 to April 15 and August 15 to September 15

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver grass seed mixture in sealed containers. Seed that is wet or moldy or that has been otherwise damaged in transit or storage will not be acceptable.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.9 MAINTENANCE SERVICE

- A. Provide lawn maintenance including, but not limited to watering, cutting, weeding, fertilizing, re-seeding areas that are not taking hold for all seeded areas for thirty (30) days after the Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SEED MIXTURE

- A. Seed Mixture: Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act.
- B. All seeds specified shall meet the current specifications on file with the City of Dayton Construction and Material Specifications, (CMSD).

- C. Seed mix required as follows:

90% Turf-type Tall Fescue
10% Kentucky Blue Grass

2.3 SOIL MATERIALS

- A. Topsoil: As specified in Specification Section 31 2000 Earth Moving.

2.4 ACCESSORIES

- A. Mulching Material: Wood cellulose fiber, free of growth or germination inhibiting ingredients.
- B. Fertilizer: FS O-F-241, recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis to the following proportions: Nitrogen 12 percent, phosphoric acid 12 percent, soluble potash 12 percent.
- C. Water: Clean, fresh, potable, and free of substances or matter which could inhibit vigorous growth of grass.
1. Water will be provided to the Landscape Contractor at the building hose bibbs.
 2. The Landscape Contractor shall furnish all equipment and hose as required to properly water the seeded areas.
- D. Herbicide: Teflan or approved equal.
- E. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass. Water will be provided to the Landscape Contractor at the building hose bibbs. The Landscape Contractor shall furnish equipment and hose as needed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that prepared topsoil base is ready to receive the work of this Specification Section.

3.2 PREPARATION OF SUBSOIL

- A. Prepare subsoil as per Specification Section 32 9113 Landscape Grading.

3.3 PLACING TOPSOIL

- A. Place topsoil as per Specification Section 32 9113 Landscape Grading.

3.4 FERTILIZING

- A. Apply fertilizer at a rate of 30 pounds per 1,000 square feet.
- B. Apply after smooth raking of topsoil and prior to roller compaction.

- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 2 inches of topsoil.
- D. Lightly water to aid the dissipation of fertilizer.
- E. Areas of the project which were seeded and mulched during preceding seasons (three months or more) shall be re-fertilized. The fertilizer shall be applied to the surface without incorporation into soil at one half the normal rate. This operation shall be performed after repair seeding and mulching operations have been completed.

3.5 SEEDING

- A. Apply seed at a rate of 6 lbs per 1,000 sq ft evenly in two intersecting directions. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Planting Season: As established by the Project Manager.
- D. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- E. Roll seeded area with roller not exceeding 112 lbs.
- F. Immediately following seeding and compacting, apply mulch to a thickness of 1/8 inches. Maintain mulch clear of shrubs and trees.
 - F. Apply water with a fine spray immediately after each area has been mulched. Saturate the depth of the topsoil.
- G. All areas to be seeded shall be seeded with seed conforming to CMSD Item 659.
- H. The Contractor shall be responsible for the production of a good close stand of grass free of weeds and bare spots. All maintenance including watering, fertilizing, weeding, mowing and repair shall be the responsibility of the Contractor until final acceptance by the Owner.

3.6 OPTIONAL HYDROSEEDING

- A. Apply seeded slurry with a hydraulic seeder at a rate of 6 lbs per 1000 sq ft evenly in two intersecting directions.
- B. Do not hydroseed areas in excess of that which can be mulched on the same day.
- C. Immediately following seeding, apply mulch to a thickness of 1/8 inches. Maintain mulch clear of shrubs and trees.
- D. Apply water with a fine spray immediately after each area has been mulched. Saturate to the depth of the topsoil.

3.8 MAINTENANCE

- A. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.

- B. Neatly trim edges and hand clip where necessary.
- C. Immediately remove clippings from Government Property after mowing and trimming.
- D. Water to prevent grass and soil from drying out.
- E. Roll surface to remove minor depressions or irregularities.
- F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- G. Immediately reseed areas which show bare spots.
- H. Protect seeded and sodded areas with warning signs during maintenance period.

3.9 SCHEDULE

- A. All project disturbed areas not scheduled to receive impervious materials, or plant bed areas shall receive grass seed in the locations as noted on the drawings and in accordance with this Specification Section. Verify extend of work and seed locations with Project Manager.

END OF SECTION

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SECTION 32 9300 - TREES, PLANTS, AND GROUND COVER

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Preparation of subsoil and topsoil.
- B. Topsoil bedding.
- C. New trees, plants and ground cover.
- D. Mulch and fertilizer.
- E. Maintenance.
- F. Tree Pruning.

1.2 RELATED SECTIONS

- A. Section 31 0000 Earthwork.
- B. Section 32 9113 Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this Section.
- C. Section 32 9200 Turf and Grasses

1.3 REFERENCES

- A. ANSI Z60.1 - American Standard for Nursery Stock.
- B. NAA (National Arborist Association) - Pruning Standards for Shade Trees.

1.4 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.
- B. Plants: Living trees, plants and ground cover specified in this Section.

1.5 SUBMITTALS

- A. Section 01 3300 Submittal Procedures: Procedures for Submittals.
- B. Certificate of Inspection of Plant Material by State or Federal Authorities.
- C. Maintenance Data: Include pruning and trimming method; types, application frequency, and recommended coverage of fertilizer for all installed plants.

- D. Submit list of plant material sources.

1.6 QUALITY ASSURANCE

- A. Nursery Qualifications: Company specializing in growing and cultivating the plants with minimum five years experience.
- B. Installer Qualifications: Company specializing in installing and planting the plants with minimum three years experience and approved by nursery.
- C. Tree Pruner Qualifications: Company specializing in pruning trees with proof of Arborist Certification.
- D. Tree Pruning: NAA - Pruning Standards for Shade Trees.
- E. Maintenance Services: Performed by qualified installer.
- F. Plant Materials: Nursery grown trees and shrubs grown in a recognized nursery in accordance with good horticultural practice with healthy root systems developed by transplanting or root pruning. Provide only healthy, vigorous stock, free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1.7 SUBSTITUTIONS

- A. Do not make substitutions of tree and shrub materials. If required landscape material is not obtainable, submit proof of non-availability to Architect's representative or designated representative and a proposal for use of equivalent material.

1.8 INSPECTION

- A. The Architect's representative or designated representative may inspect trees and shrubs either at the place of growth or at site before planting for compliance with requirements for genus, species, variety, size and quality. Architect's representative or designated representative retains the right to inspect trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from the project site and replace with new material.

1.9 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of plants, fertilizer and herbicide mixture.
- C. Plant Materials: Certified by federal or state department of agriculture Described by ASTM Z60.1; free of disease or hazardous insects.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01600.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, name of manufacturer, and certification of conformance to State regulations.
- C. Protect and maintain plant materials until planted.
- D. Deliver plant life materials immediately prior to placement. Do not deliver more plant material than can be planted in one day. Keep plants moist.
- E. Label at least one tree and one shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name. Where formal arrangements or consecutive order of trees or shrubs are shown, select stock for uniform height and spread.
- F. Prune, thin out, and shape trees and shrubs in accordance with standard horticultural practice. Prune trees to retain the required height and spread. Unless otherwise directed by the Architect's representative or designated representative, do not cut tree leaders, and remove only injured or dead branches from trees. Required shrub sizes indicated are size after pruning. Prune shrubs to retain natural character. *Any shrubs sheared into smooth regular shapes will be rejected.*

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Do not install plant materials when ambient temperatures may drop below 35 degrees F (2 degrees C) or rise above 90 degrees F (32 degrees C); where soil is frozen or muddy.
- B. Do not install plant life when wind velocity exceeds 30 mph (48 k/hr).

1.12 WARRANTY

- A. Provide one-year warranty.
- B. Warranty: Include coverage for one continuous growing season after all plant materials are installed; replace dead or unhealthy plants, or plants dead beyond normal pruning limits.
- C. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

1.13 MAINTENANCE SERVICE

- A. Maintain plant life for thirty (30) days after Date of Substantial Completion.
- B. Maintain plant life immediately after placement until plants are well established and exhibit a vigorous growing condition. Continue maintenance until termination of maintenance period.
- C. Maintenance to include:
 - 1. Cultivation and weeding plant beds and tree mulch rings.

2. Applying herbicides for weed control in accordance with manufacturer's instructions. Remedy damage resulting from use of herbicides.
 3. Remedy damage from use of insecticides.
 4. Water sufficient to saturate root system.
 5. Pruning, including removal of dead or broken branches.
 6. Disease control.
 7. Replacement of mulch.
- D. Inspect plant life at a minimum of once per week. Perform maintenance promptly.

PART 2 - PRODUCTS

2.1 TREES, PLANTS, AND GROUND COVER

- A. Trees, Plants, and Ground Cover: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.2 SIZE

- A. Provide trees and shrubs of the sizes indicated in plant list and in accordance with dimensional relationship requirements of ANSI Z60.1 for kind and shape of trees and shrubs required. Trees and shrubs of larger size than specified may be used if approved by the Architect's representative or designated representative. Size of roots or balls shall be increased proportionately.

2.3 MEASUREMENTS

- A. Measure trees and shrubs with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4 inches caliper size, and 12 inches above ground for larger sizes. Measure main body of tree or shrub for height and spread dimensions: *do not measure from branch or root tip to tip.*

2.4 SOIL MATERIALS

- A. Provide topsoil that is fertile, friable, naturally loamy, surface soil; reasonably free of subsoil, clay lumps, brush, weeds, and other litter and free of roots, stumps, stones larger than 2 inches in any dimension, and other extraneous or toxic matter harmful to plant growth. On-site soil may be used, if it is determined acceptable by the Architect's representative or designated representative.
- B. If on-site is not suitable, obtain topsoil from local sources or from areas having similar soil characteristics to that found at site of work. Obtain topsoil from naturally well-drained sites where topsoil is at least 4 inches deep; do not obtain from bogs or marshes.

2.5 SOIL AMENDMENT MATERIALS

- A. Fertilizer: Containing fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil to the following proportions: Nitrogen 11 percent, phosphoric acid 8 percent, soluble potash 4 percent.
- B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material

or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.

- C. Bone Meal: Raw, finely ground, commercial grade, minimum of 3 percent nitrogen and 20 percent phosphorous.
- D. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.
- E. Water: Clean, fresh, and free of substances or matter which could inhibit vigorous growth of plants.
 - 1. Water will be provided by the contractor at the nearest available source in the vicinity of the project. Contractor to furnish hose and other equipment.

2.6 MULCH MATERIALS

- A. Mulching Material: Mulch shall be fine grade of shredded hardwood bark, 'Paygro' or an approved equal. Mulch shall be free of foreign matter and wood particles over 6" in length or 2" in width.

2.7 ACCESSORIES

- A. Anti-desiccant: Emulsion type, film-forming agent designed to permit transpiration, but retard excessive loss, of moisture from plants. Deliver in manufacturer's fully identified containers and mix in accordance with manufacturer's instructions.

2.8 PLANT SOIL MIX

- A. A uniform mixture of 1 part sphagnum peat moss and 2 parts topsoil by volume, or as noted on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that prepared subsoil is ready to receive work; coordinate with lawn work; install plant materials after lawn grading, but prior to seed or sod work. If planting of trees and shrubs occurs after lawn work, protect lawn areas, and promptly repair damage to lawns resulting from planting operations.
- B. Saturate soil with water to test drainage.

3.2 PREPARATION OF SUBSOIL

- A. Prepare subsoil as per Specification Section 31 2000 Earth Work.
- B. Dig pits and beds 6 inches larger than plant root system.

3.3 PLACING TOPSOIL

- A. Place topsoil as per Specification Section 31 2000 Earth Work.

3.4 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after initial raking of topsoil.
- C. Mix thoroughly into the upper 2 inches of topsoil.
- D. Lightly water to aid the dissipation of fertilizer.

3.5 PLANTING

- A. Place plants for best appearance for review and final orientation by Architect's representative or designated representative.
- B. Space plants in beds as shown on drawings. Set minimum 3' from structures, pavement edges, buildings, face of curb or as noted on drawings.
- C. Set plants in pits or beds, partly filled with prepared plant mix, at a minimum depth of 6 inches under each plant. Remove all twine, bags and roping from base of trunks. Remove top 1/3 of the wire from root balls having wire baskets. Remove all rot-proof burlap.
- D. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.6 TREE PRUNING

- A. Prune trees to NAA Class 1 - Fine Pruning.
- B. Remove and replace excessively pruned or malformed stock resulting from improper pruning.

3.7 FIELD QUALITY CONTROL

- A. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.8 MAINTENANCE

- A. Neatly trim plants where necessary removing dead or broken branches. Do not sheer plants into smooth, regular shapes.
- B. Immediately remove clippings after trimming.
- C. Water to prevent soil from drying out.
 - 1. Water will be provided to the Landscape Contractor at the building hose bibbs.
 - 2. The Landscape Contractor shall furnish equipment and hose as needed.
- D. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.

- E. Apply pesticides in accordance with manufacturer's instructions.

3.9 SCHEDULE - PLANT LIST

- A. Refer to schedule on Landscape Plan.

3.10 SITE RESTORATION

- A. Daily: At the end of each day, the grounds shall be cleaned of all landscape contractor-related refuse and debris.

- B. Upon completion:

All paved surfaces affected by planting operations will be swept and hosed off.

All plant beds shall be free of weeds.

END OF SECTION

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**SECTION 33 40 00
STORM DRAINAGE UTILITIES**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This work shall consist of the construction of pipe sewers complete in place. The work shall be in accordance with these Specifications and in conformity with the lines and grades shown on the plans, or as established by the Architect. This work shall include: Excavating for pipes and bedding for same, including clearing and grubbing, fill or embankment, and the removal of all materials necessary for placing the pipe except removals listed separately; furnishing and placing granular or concrete bedding, concrete backing and granular or concrete backfill as required; constructing and subsequently removing all necessary cofferdams, cribs and sheeting; constructing and placing all necessary bulkheads; removal of water; all pipe joints; furnishing, installing and testing all necessary pipe of the types specified or shown on the plans; joining to existing and proposed sewers and appurtenances as required; restoration of disturbed facilities and surfaces; maintenance of traffic, drainage and existing facilities all as shown on the drawings and as specified.

1.02 RELATED REQUIREMENTS

- A. Refer to the City of Dayton General Provisions and Supplemental Specifications for Build America, Buy America Act (BABA) compliance requirements.

1.03 REFERENCES

- A. City of Dayton Construction and Material Specifications (CSMD).
- B. Ohio Department of Transportation Construction and Material Specifications (ODOT), Latest Edition (2019).
- C. American Society for Testing and Materials (ASTM)

1.04 SUBMITTALS

- A. Submit inlet and pipe information for approval.

PART 2 - PRODUCTS

2.01 PIPE MATERIALS

- A. Reinforce Concrete pipe conforming to CSMD item 821

2.02 INLETS

- A. Provide catch basins / curb inlets / manholes and yard drains as follows: CSMD Item 830 and Item 831.

2.03 BEDDING

- A. Type 1 bedding shall be used conforming to CMSD Item 810.

PART 3 - EXECUTION

3.01 CONSTRUCTION

- A. Conform to CSMD Item 801

3.02 LAYING CONDUIT

- A. Conform to CSMD Item 821.04.

3.03 JOINING CONDUIT

- A. Conform to CSMD Item 821.05

3.04 BACKFILLING

- A. Conform to CSMC Item 810

3.05 CLEARING SITE AND RESTORING DAMAGED SURFACES

- A. After the backfilling has been completed, the Contractor shall immediately remove and dispose of all surplus material including dirt and rubbish.
- B. After the above work is completed, the Contractor shall remove all tools and other property belonging to him, leaving the entire site in good condition.

END OF SECTION