

MONTGOMERY COUNTY
ENVIRONMENTAL SERVICES

MONTGOMERY COUNTY, OHIO



CONTRACT DOCUMENTS

FOR

Eastern Regional Water Reclamation Facility Operations Building Renovation
PROJECT NO. 130012-59

BID DATE: AUGUST 27, 2025

SPGB Architects
4333-A Tuller Rd
Dublin, Ohio 43017

MONTGOMERY COUNTY ENVIRONMENTAL SERVICES
MONTGOMERY COUNTY, OHIO

BID SUBMITTAL DOCUMENT
FOR
MONTGOMERY COUNTY, OHIO
EASTERN REGIONAL WATER RECLAMATION FACILITY OPERATIONS BUILDING
RENOVATION
PROJECT NO. 130012-59

JULY, 2025

JUDY DODGE.....COUNTY COMMISSIONER
MARY A. McDONALD COUNTY COMMISSIONER
CAROLYN RICE COUNTY COMMISSIONER
MICHAEL B. COLBERT COUNTY ADMINISTRATOR
MATT HILLIARD. DIRECTOR

DESIGN ENGINEER

SPGB ARCHITECTS

BID DATE: AUGUST 27, 2025

JANUARY 2019

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NOTICE TO BIDDERS

Bids are due electronically through Montgomery County's OpenGov Procurement portal before 1:30 p.m., Wednesday, August 27, 2025, for Project No. 130012-59, Eastern Regional Water Reclamation Facility Operations Building Renovations, for the Montgomery County Environmental Services Department. Said Bids will be opened as soon thereafter as the opening can begin. All project documents are available on Montgomery County's OpenGov Procurement portal located at: <https://procurement.opengov.com/portal/montgomerycountyoh>

This project entails a comprehensive renovation of the Eastern Regional Water Reclamation Facility Operations Building. The two-story upgrade will address essential infrastructure and aesthetic enhancements, including HVAC, plumbing, electrical, structural improvements, landscaping, and interior remodeling.

Plans and Specifications are available at 1850 Spaulding Road, Kettering, Ohio 45432, for review or by accessing Montgomery County's OpenGov Procurement Portal located at: <https://procurement.opengov.com/portal/montgomerycountyoh>, at no cost to the bidder.

Plans and Specifications may be purchased at the Bidder's cost at the location below to cover production and handling charges for each set, NONE OF WHICH WILL BE REFUNDED:

ARC, 424 East Third Street, Dayton, Ohio 45402
Ph: (937) 277-7930
www.e-arc.com/oh/dayton

A **MANDATORY** Prebid Meeting and Site Tour will be held at 10:00 a.m. on Thursday, August 7, 2025, at Montgomery County Environmental Services Offices, located at 1850 Spaulding Road, Kettering, Ohio 45432. A Site Tour of the Eastern Regional Water Reclamation Facility Operations Building, located at 1802 Spaulding Road, Kettering, Ohio, 45432, will commence immediately following the Prebid Meeting.

ENGINEER'S ESTIMATE – \$ 2,372,058.00

All Bids shall include the Bid Submittal Documents as defined in the Instructions to Bidders in Specification Section 00100.

The County Commissioners reserve the rights defined in the Instructions to Bidders, including, but not limited to the right to reject any or all Bids and to waive any irregularities of Bids, should same be to the advantage of the County.

BY ORDER OF THE BOARD OF COUNTY COMMISSIONERS OF MONTGOMERY COUNTY, OHIO.

Kyle Kolopanis, Purchasing Director

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ARTICLE 1 – BIDDER’S PLEDGE AND AGREEMENT

- 1.01 Each Bidder acknowledges that this is a public project involving public funds and that the Owner expects and requires that each Successful Bidder adhere to the highest ethical and performance standards. Each Bidder by submitting a Bid pledges and agrees that (a) it will act at all times with absolute integrity and truthfulness in its dealings with the Owner, Engineer and the Design Professional, (b) it will use its best efforts to cooperate with the Owner, Engineer and the Design Professional and all other Contractors on the Project and at all times will act with professionalism and dignity in its dealings with the Owner, Engineer, Design Professional, and other Contractors, (c) it will assign only competent supervisors and workers to the Project, each of whom is fully qualified to perform the tasks that are assigned to him/her, and (d) it has read, understands and will comply with the terms of the Contract Documents.

ARTICLE 2 – EXAMINATION OF CONTRACT DOCUMENTS AND SITE CONDITIONS AND RELIANCE UPON TECHNICAL DATA

- 2.01 Each Bidder shall have a competent person carefully and diligently review each part of the Contract Documents, including the Divisions of the Specifications and parts of the Drawings that are not directly applicable to the Work on which the Bidder is submitting its Bid. By submitting its Bid, each Bidder represents and agrees, based upon its careful and diligent review of the Contract Documents, that it is not aware of any conflicts, inconsistencies, errors, or omissions in the Contract Documents for which it has not notified the Engineer in writing at least seven (7) days prior to the Bid opening. If there are any such conflicts, inconsistencies, errors, or omissions in the Contract Documents, the Bidder (i) will provide the labor, equipment, or materials of the better quality or greater quantity of Work and/or (ii) will comply with the more stringent requirements. The Bidder will not be entitled to any additional compensation for any conflicts, inconsistencies, errors, or omissions that would have been discovered by such careful and diligent review, unless it has given prior written notice to the Engineer.
- 2.02 Each Bidder shall have a competent person carefully and diligently inspect and examine the entire site and the surrounding area, including all parts of the site applicable to the Work for which it is submitting its Bid, including location, condition, and layout of the site and the location of utilities, and carefully correlate the results of the inspection with the requirements of the Contract Documents. The Bidder’s Bid shall include all costs attributable to site and surrounding area conditions that would have been discovered by such careful and diligent inspection and examination of the site and the surrounding area, and the Bidder shall not be entitled to any Change Order, additional compensation, or additional time on account of such conditions.
- 2.03 The Bidder may rely upon the general accuracy of any technical data identified in the Owner-Contractor Agreement (e.g., any soils exploration reports, soil boring logs, site survey, or abatement reports) in preparing its Bid, but such technical data are not part of the Contract Documents. Except for the limited reliance described in the preceding sentence, Bidder may not, if awarded a contract for the Work, rely upon or make any Claim against the Owner or Design Professional, or any of their agents or employees, with respect to any of the following:
- A. the completeness of such reports and drawings for Bidder’s purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by the Successful Bidder and safety precautions and programs incident thereto; or

- B. any interpretation by the Successful Bidder 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 Bidder to estimate locations or quantities of subsurface strata are independent factual assumptions, which Owner does not warrant.
- 2.04 Each Bidder will be deemed to have actual knowledge of all information provided or discussed at the pre-bid meeting.

ARTICLE 3 – OWNER, ENGINEER AND DESIGN PROFESSIONAL

The Owner, Engineer and the Design Professional are defined in the General Conditions.

ARTICLE 4 – PROJECT

- 4.01 The Project and Work for the Project consists of all labor, materials, equipment, and services necessary for the construction of the Project identified in the Contact Documents, including Section 01100.
- 4.02 On request and by appointment, Owner may conduct a site visit during Owner's normal business hours for any Bidder requesting such a visit. All visits shall be scheduled through the Owner.
- 4.03 Subject to a prior, written request from a Bidder and prior authorization from the Owner, Owner may provide Bidders access to the Project site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable laws and regulations relative to excavation and utility locations.
- 4.04 Any pre-bid meetings for the Project will be identified in the Notice to Bidders in Specification Section 00020 or in any Addenda issued by Owner. Bidders may visit the Project site following any pre-bid conference scheduled by Owner.

ARTICLE 5 – WORK

- 5.01 The Project consists of the following Contract(s) for the Work:

Bid Package # and Description

Project No. 130012-59: Eastern Regional Water Reclamation Facility Operations Building Renovations

- 5.02 If only one Bid package is listed, one Contract will be issued by the Owner for constructing the Project, the General Contract, which will cover all scopes of Work necessary to construct the Project.
- 5.03 The Contractor awarded the General Contract (General Contractor) will be responsible for the performance and coordination of any and all subcontractors and suppliers either directly or indirectly contracted with the General Contractor.

ARTICLE 6 – ESTIMATE OF COST

The total estimated construction cost for the Base Bid Work for all Bid packages on the Project for which Bids are being solicited at this time is provided in the Notice to Bidders in Specification Section 00020, unless modified by Addenda.

ARTICLE 7 – CONTRACT DOCUMENTS

- 7.01 The Contract Documents consist of the Contract Documents listed in Article 1 of the Owner-Contractor Agreement in Specification Section 00510.
- 7.02 The Contract Documents will be available to be purchased at the location(s) identified in the Notice to Bidders in Specification Section 00020 and/or in the location(s) identified in any Addenda issued by Owner for the Project. Owner reserves the right to charge a non-refundable amount for the actual cost of the Contract Documents.
- 7.03 Bidders shall use complete sets of Contract Documents in preparing Bids. Neither the Owner, Engineer and/or the Design Professional assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Contract Documents.
- 7.04 The Owner, Engineer and/or the Design Professional, in making the Contract Documents available on the above terms, do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant for any other use.
- 7.05 To the extent that any reports of investigations and tests of subsurface and other conditions at the site or those reports that otherwise may affect cost, progress, performance or furnishing of the Work which have been utilized by Design Professional in preparation of the Drawings and Specifications, they are identified as “Non-Contract Documents” in the Owner-Contractor Agreement in Specification Section 00510. Copies of such reports will either be included as a separately bound document with each set of the Bidding Documents or will be provided upon request by Bidder. These reports are not intended to constitute any explicit or implicit representation as to the nature of the subsurface and latent physical conditions which may be encountered at the site or to constitute explicit or implicit representations as to any other matter contained in any report. Such reports are not guaranteed as to completeness and are not part of the Contract Documents. Before submitting its Bid, Bidder will, at its own expense, make such investigations and tests as the Bidder may deem necessary to determine its Bid for performing and furnishing the Work in accordance with the Contract Documents.

ARTICLE 8 – PREPARATION OF BIDS

- 8.01 All Bids must be submitted on the "Bid Form" furnished with the Contract Documents in Specification Section 00400.
- 8.02 All blank spaces shall be filled in, in words and figures, and in figures only where no space is provided for words and signed by the Bidder. The wording on the Bid Form shall be used without change, alteration, or addition. Any change in the wording or omission of specified accompanying documents may cause the Bid to be rejected. If there is an inconsistency or conflict in the Bid amount, the lowest amount shall control, whether expressed in numbers or words. Ditto marks shall not be used.
- 8.03 Bidders shall note receipt of Addenda on the Bid Form. If the Bidder fails to acknowledge receipt of each Addendum, the Bid shall be deemed non-responsive, unless the Bid amount

clearly and unambiguously reflects receipt of the Addendum or the Addendum involves only a matter of form and does not affect the price, quantity or quality of the Work to be performed.

- 8.04 Each Bidder shall submit their Bid electronically through Montgomery County's OpenGov Procurement portal to the Owner. The Bid Form shall be signed with the name typed or printed below the signature. A Bid shall not be submitted by facsimile transmission. A Bidder that is a corporation shall sign its Bid with the legal name of the corporation followed by the name of the state of incorporation and the legal signature of an officer authorized to bind the corporation to a contract.
- 8.05 Each Bid shall be submitted in accordance with the Notice to Bidders, unless modified by any Addenda issued by Owner.
- 8.06 The completed Bid shall include the following documents (referred to as the "Bid Submittal Documents"):
- A. Bid Form (Section 00400)
 - B. Bid Guaranty or Bid and Performance/Payment Bond (Section 00410)
 - C. Bidder's Qualification Statement (Section 00420)
 - D. Drug-Free Workplace Compliance Affidavit (Section 00450)
 - E. Disclosure Policy (Section 00491)
- 8.07 The Bidder shall take the following precautions in preparing its Bid:
- A. Sign the Bid and check to ensure all blank spaces have been filled in with requested information and that the specified accompanying documents (listed in Paragraph 8.06 above) have been included as described in Paragraph 8.05 above.
 - B. When the Bid Form provides for quoting either an addition or deduction for an alternate item, indicate whether the sum named is an addition or deduction. If it is not indicated, it will be conclusively presumed that the amount is a deduction.
 - C. When the Bid Form provides for quoting a unit price, the Bidder should quote the unit price as set forth in the Bid Documents.
 - D. When applicable, make sure that the Bid Guaranty is properly executed and signed by:
 - 1. The Bidder
 - 2. The surety or sureties.
 - E. Make sure that the amount of the Bid Guaranty (if the Bid Guaranty is in the form of a certified check, letter of credit, or cashier's check) is for a specific sum in an amount as instructed in Paragraph 8.08 A below. If the Bid Guaranty is in the form of the Bid Guaranty and Performance/Payment Bond, the amount may be left blank; if an amount is inserted, it must equal the total of the Base Bid and all add alternates included. If inserted, then the failure to state an amount equal to the total of the Base Bid and all add alternates shall make the Bid non-responsive if the Owner selects alternates not included in the amount.

- F. Make sure that the appropriate Bid package and scope of Work is inserted in the correct space on the Bid Guaranty and Performance/Payment Bond Form. Failure to include Work covered by the Bid submitted may make the Bid non-responsive.

8.08 Bonds and Guarantees

- A. Bid Guaranty: Bidder shall furnish a Bid Guaranty, in the form prescribed in Sections 153.54, 153.57, and 153.571 of the Ohio Revised Code, in the form of either: (1) a bond for the full amount of the Bid in the form of the Bid and Performance/Payment Bond included in the Contract Documents in Specification Section 00410; or (2) a certified check, cashier's check, or irrevocable letter of credit in a form satisfactory to the Owner in an amount equal to 10% of the Bid. Bid amount shall be the total of all sums bid, including all add alternates, but excluding all deduct alternates. NOTE: AIA Bid Bond forms are not acceptable.
- B. Performance/Payment Bond: The Successful Bidder, who, as a Bid Guaranty, submits a certified check, cashier's check, or irrevocable letter of credit in an amount equal to 10% of the Bid, shall furnish a Performance/Payment Bond in the form of the Performance/Payment Bond included in Specification Section 00512 in the Contract Documents in an amount equal to 100% of the Contract Sum. NOTE: AIA Bond forms are not acceptable.
- C. The bond must be issued by a surety company authorized by the Ohio Department of Insurance to transact business in the State of Ohio and acceptable to the Owner. The bond must be issued by a surety capable of demonstrating a record of competent underwriting, efficient management, adequate reserves, and sound investments. These criteria will be deemed to be met if the surety currently has an A.M. Best Company Policyholders Rating of "A-" or better and has or exceeds the Best Financial Size Category of Class VI. Other sureties may be acceptable to the Owner, in its sole discretion
- D. All bonds shall be signed by an authorized agent of an acceptable surety and by the Bidder.
- E. Surety bonds shall be supported by credentials showing the Power of Attorney of the agent, a certificate showing the legal right of the surety company to do business in the State of Ohio, and a financial statement of the surety.
- F. The Bid Guaranty, as applicable, shall be in the name of or payable to the order of the Owner.
- G. The name and address of the surety and the name and address of the surety's agent should be typed or printed on each bond.

ARTICLE 9 – METHOD OF AWARD

- 9.01 All Bids shall remain open for acceptance for sixty (60) days following the day of the Bid opening, but the Owner may, in its sole discretion, release any Bid and return the Bid Guaranty prior to that date. The Bid Guaranty shall be subject to forfeiture, as provided in the Ohio Revised Code, if a Bid is withdrawn during the period when Bids are being held.
- 9.02 The Owner reserves the right to reject any, part of any, or all Bids and to waive any informalities and irregularities. The Bidder expressly acknowledges this right of the Owner to reject any or all Bids or to reject any incomplete or irregular Bid. Bidders must furnish all information requested on or accompanying the Bid Form. Failure to do so may result in disqualification of the Bid.

9.03 Determination of the Lowest and Best Bid. Subject to the right of the Owner to reject any or all Bids, the Owner will award the Contract for the Work to the responsible Bidder submitting the lowest and best Bid, taking into consideration accepted alternates. In evaluating Bids, the Owner may consider the qualifications of the Bidders, whether or not the Bids comply with the prescribed requirements, and alternates and unit prices, if requested, on the Bid Form. The Owner may also consider the qualifications and experience of subcontractors and suppliers. The Owner may conduct such investigations as are deemed necessary to establish the qualifications and financial ability of the Bidder and its subcontractors and suppliers. The factors the Owner may consider in determining which Bid is lowest and best include the factors set forth below. The Owner, in its discretion, may consider and give such weight to these criteria as it deems appropriate.

- A. The Bidder's Work History. The Bidder should have a record of consistent customer satisfaction and of consistent completion of projects, including projects that are comparable to or larger and more complex than the Owner's Project, on time and in accordance with the applicable Contract Documents, and the Bidder's claims history. If the Bidder's management operates or has operated another construction company, the Owner may consider the work history of that company in determining whether the Bidder submitted the lowest and best Bid.
1. The Owner will consider the Bidder's prior experience on other projects of similar scope and/or complexity including prior projects with the Owner and/or Design Professional, including the Bidder's demonstrated ability to complete its work on these projects in accordance with the Contract Documents and on time, and will also consider its ability to work with the Owner and Design Professional as a willing, cooperative, and successful team member. Bringing overstated claims, an excessive number of claims, acting uncooperatively, and filing lawsuits against project owners and/or their design professionals on prior projects of similar scope and/or complexity will be deemed evidence of a Bidder's inability to work with the Owner and Design Professional as a willing, cooperative, and successful team member.
 2. The Bidder authorizes the Owner and its representatives to contact the owners and design professionals (and construction managers, if applicable) on projects on which the Bidder has worked and authorizes and requests such owners and design professionals (and construction managers) to provide the Owner with a candid evaluation of the Bidder's performance. By submitting its Bid, the Bidder agrees that if it or any person, directly or indirectly, on its behalf or for its benefit brings an action against any of such owners or design professionals (or construction managers) or the employees of any of them as a result of or related to such candid evaluation, the Bidder will indemnify and hold harmless such owners, design professionals (and construction managers) and the employees of any of them from any claims whether or not proven that are part of or are related to such action and from all legal fees and expenses incurred by any of them arising out of or related to such legal action. This obligation is expressly intended for the benefit of such owners, design professionals (and construction managers), and the employees of each of them.
- B. The Bidder's financial ability to complete the Contract successfully and on time without resort to its surety.
- C. The Bidder's prior experience with similar work on comparable or more complex projects.
- D. The Bidder's prior history for the successful and timely completion of projects, including the Bidder's history of filing claims and having claims filed against it.

- E. The Bidder's equipment and facilities.
- F. The adequacy, in numbers and experience, of the Bidder's work force to complete the Contract successfully and on time.
- G. The Bidder's compliance with federal, state, and local laws, rules, and regulations, including, but not limited to, the Occupational Safety and Health Act, the Ohio Prevailing Wage laws, and Ohio ethics laws.
- H. The foregoing information with respect to each of the subcontractors and suppliers that the Bidder intends to use on the Project.
- I. The Bidder's participation in a drug-free workplace program acceptable to the Owner, and the Bidder's record for both resolved and unresolved findings of the Auditor of State for recovery as defined in Section 9.24 of the Ohio Revised Code.
- J. The Owner's prior experience with the Bidder's surety.
- K. Evidence that the Bidder is qualified to do business in the State of Ohio or the ability of the Bidder to obtain such qualification prior to execution of the Owner-Contractor Agreement.
- L. The Bidder's interest in the Project as evidenced by its attendance at any pre-bid meetings or conferences for Bidders.
- M. Depending upon the type of the Work, other essential factors, as the Owner may determine and as are included in the Specifications.

9.04 Qualifications Statement. Each Bidder will submit with its Bid a completed Bidder's Qualifications Statement, which is included in Specification Section 00420 of the Contract Documents, and thereafter provide the Owner, Engineer and/or the Design Professional promptly with such additional information as the Owner, Engineer and/or the Design Professional may request regarding the Bidder's qualifications. A Bidder shall submit any requested additional information within five (5) business days of the date of the request.

9.05 The failure to submit requested information on a timely basis may result in the determination that the Bidder has not submitted the lowest and best Bid.

9.06 By submitting its Bid, the Bidder agrees that the Owner's determination of which Bidder is the lowest and best Bidder shall be final and conclusive, and that if the Bidder or any person on its behalf challenges such determination in any legal proceeding, the Bidder will indemnify and hold the Owner and its employees and agents harmless from any claims included or related to such legal proceeding, whether or not proven, and from legal fees and expenses incurred by the Owner, its employees, or agents that arise out of or are related to such challenge.

9.07 After Bid opening, within five (5) business days of a request made by the Owner, Engineer and/or the Design Professional, the apparent low Bidder and any other Bidder so requested by the Owner, Engineer and/or the Design Professional must submit the following:

- A. For all subcontracts and supplier contracts with an estimated value of at least \$20,000, a list of all Subcontractors and Suppliers that the Bidder will use to construct the Project, as well as an indication of whether or not the Bidder has ever worked with a proposed subcontractor or Supplier before, including the following information for the three most recent projects on which the Bidder and each subcontractor and Supplier have worked together:

1. Project Owner
 2. Project Name
 3. Subcontract Scope
 4. Subcontract Value
 5. Owner's contact name and phone number.
- B. If Bidder and a proposed subcontractor or supplier have not worked together on at least three projects in the past five years, Bidder must submit the information set forth above for the three most recent similar projects to the Project that a proposed subcontractor or supplier has worked on.
- C. The above subcontractor and/or supplier information, as well as the information pertaining to each proposed subcontractor and/or supplier, shall be used in the Owner's determination of the lowest and best Bid.
- D. Once a Bidder identifies its proposed subcontractors and suppliers as set forth herein, and Owner makes no objections, the list shall not be changed unless written approval of the change is authorized by the Owner and Design Professional.
- 9.08 Affidavit as to Personal Property Taxes. Each Successful Bidder shall submit, prior to the time of the entry into the Contract, an affidavit in the form required by Section 5719.042, Ohio Revised Code, regarding the status of the Bidder's personal property taxes. A copy of the affidavit form is included with the Contract Documents in Specification Section 00560.
- 9.09 No Bidder may withdraw its Bid within sixty (60) days after the date Bids are opened. The Owner reserves the right to waive any formalities or irregularities or to reject any or all Bids.
- 9.10 The Owner reserves the right to disqualify Bids, before or after opening, upon evidence of collusion with intent to defraud or other illegal practices on the part of the Bidder.
- 9.11 Award of Contract. The award of the Contract, when required, will only be made pursuant to a duly adopted resolution of the Owner.
- 9.12 More than one (1) Bid for the same Work from an individual, or a firm, partnership, corporation or an association under the same or different names will not be considered. Reasonable grounds for believing that any Bidder is interested in more than one (1) Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder is interested, unless the Bidding Documents specifically invite or permit combination bids.

ARTICLE 10 – EXECUTION OF CONTRACT

- 10.01 Within the time designated by the Owner after award of the Contract, the Successful Bidder shall execute and deliver to the Owner the required number of copies of the Owner-Contractor Agreement, in the form included in the Contract Documents in Specification Section 00510, and all accompanying documents requested, including, but not limited to, a Performance/Payment Bond in Specification Section 00512 (if applicable), Non-Collusion Affidavit (Principal Contractor) in Specification Section 00561, insurance certificates, and a valid Workers' Compensation Certificate. The Successful Bidder shall have no property interest or rights under the Owner-Contractor Agreement until the Agreement is executed by the Owner.

ARTICLE 11 – SUBSTITUTIONS/NON-SPECIFIED PRODUCTS

- 11.01 Certain brands of material or apparatus are specified. Each Bid will be based on these brands, which may be referred to in the Contract Documents as Standards. The use of another brand (referred to as a substitution or proposed equal in the Contract Documents, when a Bidder or the Contractor seeks to have a different brand of material or apparatus than that specified approved by the Owner for use in the Project) may be requested as provided herein.
- 11.02 The products specified in the Contract Documents establish a standard of required function, dimension, appearance, and quality.
- 11.03 Bidders wishing to obtain approval to bid non-specified products shall submit written requests to the Engineer, using the Pre-Bid Substitution Form (Specification Section 00110) a minimum of ten (10) working days before the Bid date and hour. To facilitate the submission of requests, a Pre-Bid Substitution Form is included in the Contract Documents. The Bidder shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution, including the name of the proposed manufacturer and/or product and a complete description of the proposed product including manufacturer's name and model number or system proposed, drawings, product literature, performance and test data, color selections or limitations, and any other information necessary for evaluation. Include a statement including any changes in other materials, equipment, or other work that would be required if the proposed product is incorporated in the materials, equipment, or other work that would be required if the proposed product is incorporated in the Work. The burden of proof of the merit of the proposed product is on the proposer. The Engineer's decision on approval of a proposed product will be final.
- A. The following will be cause for rejection of a proposed substitution:
1. Requests submitted by subcontractors, material suppliers, and individuals other than Bidders;
 2. Requests submitted without adequate documentation;
 3. Requests received after the specified cut-off date.
- 11.04 When the Engineer approves a product submission before receipt of Bids, the approval will be included in an Addendum, and Bidders may include the pricing of this product in their Bid. Bidders shall not rely on approvals made in any other manner.
- 11.05 In proposing a non-specified product or a substitution, the Bidder represents and warrants that each proposed product will not result in any changes to the Project, including changes to the Work of other contractors, or any decrease in the performance of any equipment or systems to be installed in the Project and agrees to pay any additional costs incurred by the Owner and the Owner's consultants as a result of a non-specified or substitute product that is accepted.
- 11.06 Following the award of the Contract, there shall be no substitutions for specified products, except pursuant to a Change Order. The Owner in its sole discretion may decline to consider a substitution for a Change Order.

ARTICLE 12 – ALTERNATES

- 12.01 The Owner may request Bids on alternates. If the Owner requests Bids on alternates, the Bidder should include the cost of the alternates requested on its Bid Form.

- 12.02 At the time of awarding the Contract, the Owner will select or reject alternates as it determines is in its best interest. A Bidder's failure to include on its Bid Form the cost of an alternate selected by the Owner and applicable to the Bidder's work shall render the Bid non-responsive and be grounds for the rejection of the Bid. Otherwise, the failure to include the cost of an alternate will not be deemed material.
- 12.03 The Bidder acknowledges that although there is an estimate for the cost of the Project, the market conditions may and frequently do result in the estimate being different from the sum of the Bids received, either higher or lower. The Bidder understands that the Owner may include alternates, which may include deduct alternates as well as add alternates, to give it flexibility to build the Project with the funds available. The Bidder further understands and acknowledges that use of add and deduct alternates is a long held customary practice in the construction industry in the State of Ohio. The Bidder also acknowledges that the Owner will not make a decision about the alternates on which to base the award of contracts until the Bids are received, and the Owner can compare its available funds with the Base Bids and the cost or savings from selecting different alternates. The Bidder understands that the award to the Bidder submitting the lowest and best Bid will be based on the lowest Base Bid plus selected alternates and may result in an award to a Bidder other than the Bidder that submitted the lowest Base Bid.
- 12.04 If, during the progress of the Work, the Owner desires to reinstate any alternate not included in the Contract, the Owner reserves the right to reinstate the alternate at the price bid by the Contractor provided that such action is taken in sufficient time so as not to delay the progress of the Work or cause the Contractor additional expense.

ARTICLE 13 – UNIT PRICES AND BID SUMMARY SHEETS

13.01 DEFINITION

- A. If the Bid is based on UNIT PRICES, the Bid Form shall include a Unit Price Sheet to be completed by Bidders. Unit Prices are defined as the cost per single unit for each Bid Item. When the Bid Item's estimated quantity is "Lump Sum" or "1 each," this quantity amount is equal to a single unit.
- B. For each Bid Item, the "Unit Price Sheet(s)" requires the Bidder to enter UNIT PRICES, IN FIGURES, for LABOR COST and for MATERIAL COST, a COMBINED UNIT PRICE that totals the labor and materials unit prices, and a BID ITEM TOTAL COST, which multiplies the combined unit price by the estimated quantity.

13.02 SAMPLE Unit Price Sheet

- A. In the Sample "Unit Price Sheet" below, there are six (6) columns labeled "A" through "F". Column "A" is the Bid's "ESTIMATED QUANTITY." Column "B" is the UNIT of Measure for the ESTIMATED QUANTITY. Column "C" is the Bid's "UNIT PRICE" for labor and Column "D" is the Bid's "UNIT PRICE" for materials. Column "E" is the Bid's "TOTAL UNIT PRICE" of labor and materials. Column "F" is the Bid's "TOTAL COST OF ITEM." Bidder MUST enter, in figures, the unit cost in Column "C" and Column "D" for each Bid Item. These amounts should then be added together, and the resulting sum entered in Column "E" for each Bid Item. The TOTAL cost for each Bid Item (Column "F") is calculated by multiplying the quantity of Column "A" by the amount entered in Column "E."
- B. The Bidder MUST submit an unofficial "BIDDER'S TOTAL PRICE", which is the grand total of prices entered in Column "F" for all Bid Items. This amount should be recorded in the box at the bottom of Column "F" and will be the figure read aloud at the Bid opening.

The following examples are illustrative only and may not apply to the specific requirements for this project.

Example of an accurately completed Unit Price Sheet

Bid Item No.	Bid Item Description	Estimated Quantity (A)	Units (B)	Unit Cost			Bid Item Total Cost (F) (F=AxE)
				Labor (C)	Materials (D)	Combined Unit Price (E) (E=C+D)	
1	Mobilization	1	LS	\$3,000.00	\$7,000.00	\$10,000.00	\$10,000.00
2	Traffic Control	1	LS	\$6,000.00	\$14,000.00	\$20,000.00	\$20,000.00
3	Fire Hydrant	10	EA	\$2,000.00	\$3,000.00	\$5,000.00	\$50,000.00
4	1" Copper Service	1500	LF	\$10.00	\$40.00	\$50.00	\$75,000.00
Bidder's Total Price =							\$155,000.00

- 13.03 All figures in the Unit Price Bid will be considered to reflect the intention of the Bidder.
- 13.04 In order to be considered, all Bids must contain all Unit Prices (separate and combined) and a Bidder's Total Price.
- 13.05 The Owner will verify the accurate mathematical totaling of all Bid amounts provided on the Unit Price Sheet(s), including the calculation of Column "E" and Column "F" and the Bidder's Total Price, which is the sum of Column "F". In the event there are any mathematical errors on the Bidder's Unit Price Sheet for the Bidder's calculation of any of the Bidder's Combined Unit Price(s) in Column "E," any of the Bidder's Bid Item Total Costs in Column "F" or the Bidder's Total Price, which is the sum of Column "F," the mathematical totaling of the amounts in Column "E" and Column "F", and the mathematical total of the sum of Column "F," as determined by Owner, shall control over the amounts inserted by Bidder in Column "E," Column "F" or the Bidder's Total Price.
- 13.06 The quantities in the column titled "Estimated Quantity" are those given in the Owner's approximate estimation and are those which will be used for the purpose of determining the lowest Bidder. These quantities are approximate only, and the contractor to whom the Contract is awarded shall not be entitled to any claim for loss or profits, nor for other damages, should the quantity of Work done prove to be greater or less than is herein given in said Estimated Quantity columns.

ARTICLE 14 – ADDENDA

- 14.01 The Owner reserves the right to issue Addenda changing, altering, or supplementing the Contract Documents prior to the time set for receiving Bids. The Owner will issue the Addenda to clarify Bidders' questions and/or to change, alter, or supplement the Contract Documents.
- 14.02 Any explanation, interpretation, correction, or modification of the Contract Documents will be issued in writing in the form of an Addendum, which shall be the only means considered binding; explanations, interpretations, etc., made by any other means shall NOT be legally binding. All Addenda shall become a part of the Contract Documents.

- 14.03 Bidders shall submit written questions to the Owner in sufficient time in advance of the Bid opening to allow sufficient time for the Owner and/or Design Professional to respond. In order to receive consideration, questions must be received by the Owner at least seven (7) days prior to the date of the opening of Bids. All Addenda will be issued, except as hereafter provided, and e-mailed or otherwise furnished to potential bidders present at the mandatory Pre-Bid meeting for the project, at least seventy-two (72) hours prior to the published time for the opening of Bids, excluding Saturdays, Sundays, and legal holidays. If any Addendum is issued within such seventy-two (72) hour period, then the time for opening of Bids shall be extended one (1) week with no further advertising of Bids required.
- 14.04 Copies of each Addendum will NOT be sent to the Bidders. The Montgomery County Purchasing Department will publish all Addenda at: <https://procurement.opengov.com/portal/montgomerycountyoh>. Bidders are responsible for acquiring issued Addenda in time to incorporate them into their Bid. Bidders should contact the Montgomery County Purchasing Department at <https://procurement.opengov.com/portal/montgomerycountyoh> prior to the Bid opening to verify the number of Addenda issued. Receipt of Addenda shall be indicated by Bidders in the space provided on the Bid Form.
- 14.05 Each Bidder shall carefully read and review the Contract Documents and immediately bring to the attention of the Owner any error, omission, inconsistency, or ambiguity therein.
- 14.06 If a Bidder fails to indicate receipt of all Addenda through the last Addendum issued by the Montgomery County Purchasing Department on its Bid Form, the Bid of such Bidder will be deemed to be responsive only if:
- A. The Bid received clearly indicates that the Bidder received the Addendum, such as where the Addendum added another item to be bid upon and the Bidder submitted a Bid on that item; or
 - B. The Addendum involves only a matter of form or is one which has either no effect or has merely a trivial or negligible effect on price, quantity, quality, or delivery of the item bid upon.

ARTICLE 15 – INTERPRETATION

- 15.01 If a Bidder contemplating submitting a Bid for the proposed Project is in doubt as to the true meaning of any part of the Contract Documents, it may submit a written request for an interpretation thereof to the Owner. Requests received fewer than seven (7) days prior to Bid opening may not be answered. Any interpretation of the proposed documents will be made by Addendum only, duly signed by the Owner and/or Design Professional, and a copy of such Addendum will be available on the County's website to potential bidders present at the mandatory Pre-Bid meeting and each Plan Room where the Contract Documents are maintained. The Owner will not be responsible for any other explanation or interpretation of the proposed documents.
- 15.02 In interpreting the Contract Documents, words describing materials that have a well-known technical or trade meaning, unless otherwise specifically defined in the Contract Documents, shall be construed in accordance with the well-known meaning recognized by the trade.
- 15.03 Bidders are responsible for notifying the Owner in a timely manner of any ambiguities, inconsistencies, errors, or omissions in the Contract Documents. The Bidder shall not, at any time after the execution of the Contract, be compensated for a claim alleging insufficient data, incomplete Contract Documents, or incorrectly assumed conditions regarding the nature or character of the Work, if no request was made by the Bidder prior to the Bid opening.

ARTICLE 16 – STATE SALES AND USE TAXES

- 16.01 The Owner is a political subdivision of the State of Ohio and is exempt from taxation under the Ohio Sales Tax and Use Tax laws. Building materials that the Successful Bidder purchases for incorporation into the Project will be exempt from state sales and use taxes if the Successful Bidder provides a properly completed Ohio Department of Taxation Construction Contract Exemption Certificate to the vendors or suppliers when the materials are acquired. The Owner will execute properly completed certificates on request.

ARTICLE 17 – DATE FOR SUBSTANTIAL COMPLETION / DATE FOR CONTRACT COMPLETION / LIQUIDATED DAMAGES

- 17.01 The Milestone Dates, including the Milestone Date for Substantial Completion (aka Contract Time), the Milestone Date for Contract Completion, and Liquidated Damages shall be as defined and set forth in the Owner-Contractor Agreement in Specification Section 00510. By submitting its Bid, each Bidder agrees that the period for performing its Work is reasonable.

ARTICLE 18 – OWNER'S RIGHT TO WAIVE DEFECTS AND IRREGULARITIES

- 18.01 The Owner reserves the right to waive any and all irregularities provided that the defects and irregularities do not affect the amount of the Bid in any material respect or otherwise give the Bidder a competitive advantage.

ARTICLE 19 – MODIFICATION/WITHDRAWAL OF BIDS

- 19.01 Modification. A Bidder may modify its Bid by written communication to the Owner addressed to the Owner's Representative at any time prior to the scheduled closing time for receipt of Bids, provided such written communication is received by Owner's Representative prior to the Bid deadline. The written communication shall not reveal the Bid price but should provide the addition or subtraction or other modification so that the final prices or terms will not be known until the sealed Bid is opened. If the Bidder's written instructions with the change in Bid reveal the Bid amount in any way prior to the Bid opening, the Bid may be rejected as non-responsive.
- 19.02 Withdrawal Prior to Bid Deadline. A Bidder may withdraw its Bid at any time for any reason prior to the Bid deadline for the opening of Bids established in the Notice to Bidders. The request to withdraw shall be made in writing to and received by the Owner's Representative prior to the time of the Bid opening.
- 19.03 Withdrawal after Bid Deadline.
- A. All Bids shall remain valid and open for acceptance for a period of at least sixty (60) days after the Bid opening; provided, however, that a Bidder may withdraw its Bid from consideration after the Bid deadline when all of the following apply:
1. the price bid was substantially lower than the other Bids;
 2. the reason for the Bid being substantially lower was a clerical mistake, rather than a mistake in judgment, and was due to an unintentional and substantial error in arithmetic or an unintentional omission of a substantial quantity of work, labor, or material;
 3. the Bid was submitted in good faith; and

4. the Bidder provides written notice to the Owner, to the attention of the Owner's Representative, within two (2) business days after the Bid opening for which the right to withdraw is claimed.
- B. No Bid may be withdrawn under this provision if the result would be the awarding of the Contract on another Bid for the Bid Package from which the Bidder is withdrawing its Bid to the same Bidder.
- C. If a Bid is withdrawn under this provision, the Owner may award the Contract to another Bidder determined by the Owner to be the lowest and best Bidder or the Owner may reject all Bids and advertise for other Bids. In the event the Owner advertises for other Bids, the withdrawing Bidder shall pay the costs incurred in connection with the rebidding by the Owner, including the cost of printing new Contract Documents, required advertising, and printing and mailing notices to prospective Bidders, if the Owner finds that such costs would not have been incurred but for such withdrawal.

ARTICLE 20 – COMPLIANCE WITH APPLICABLE LAWS

- 20.01 By submitting a Bid for Work on the Project, the Bidder acknowledges that it is in compliance with applicable federal, state, and local laws and regulations, including, but not limited to, the following:
- A. Equal Employment Opportunity/Nondiscrimination. The Bidder agrees that if it is awarded a contract that in the hiring of employees for performance of work under the contract or any subcontract, neither it nor any subcontractor, or any person acting on its behalf or its subcontractor's behalf, by reason of race, creed, sex, disability as defined in Section 4112.01 of the Ohio Revised Code, or color, shall discriminate against any citizen of the state in the employment of labor or workers who are qualified and available to perform work to which the employment relates. The Bidder further agrees that neither it nor any subcontractor or any person on its behalf or on behalf of any subcontractor, in any manner, shall discriminate against or intimidate any employees hired for the performance of the work under the contract on account of race, creed, sex, disability as defined in Section 4112.01 of the Ohio Revised Code, or color.
 - B. Ethics Laws. The Bidder represents that it is familiar with all applicable ethics law requirements, including without limitation Sections 102.04 and 3517.13 of the Ohio Revised Code, and certifies that it is in compliance with such requirements.
- 20.02 Particular attention is called to the statutory requirements of the State of Ohio relative to licensing of corporations organized under the laws of any other state. These requirements include, but are not necessarily limited to, the stipulations contained in Section 1703.04 of the Ohio Revised Code.
- 20.03 The Bidder shall certify, by notarized statement, on the Drug-Free Workplace Compliance Affidavit Form as provided in Specification Section 00450, that it is enrolled and in good standing with the Ohio Bureau of Workers' Compensation Drug-Free Workplace Program, or enrolled and in good standing with a comparable program, which has been approved by the Bureau of Workers' Compensation, prior to providing any labor at the Project site of the public improvement, which is the subject of this Bid, pursuant to O.R.C. § 153.03 and § 153.031. The Bidder shall also agree, on the same affidavit, that it will be contractually responsible for ensuring that all subcontractors of any tier shall be enrolled and in good standing with the Ohio

Bureau of Workers' Compensation, or with a comparable Bureau approved program, prior to the provision of any labor at the subject public project site by any such subcontractor.

ARTICLE 21 – FINDINGS FOR RECOVERY

- 21.01 By submitting its Bid, each Bidder certifies for reliance of the Owner that it has no unresolved finding for recovery against it issued by the Auditor of the State of Ohio on or after January 1, 2001, except as permitted by Section 9.24 (F) of the Ohio Revised Code.

ARTICLE 22 – PREVAILING WAGES

- 22.01 The Successful Bidder and all of its subcontractors, regardless of tier, will strictly comply with its obligation to pay a rate of wages on the Project not less than the rate of wages fixed for this Project under Section 4115.04 of the Ohio Revised Code. Additionally, the Successful Bidder will comply with all other provisions of Chapter 4115 of the Ohio Revised Code.

END OF SECTION

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SECTION 00400

BID FORM

BID FOR:

MONTGOMERY COUNTY, OHIO

DELIVER BID TO:

BOARD OF COUNTY COMMISSIONERS
MONTGOMERY COUNTY, OHIO
MONTGOMERY COUNTY ADMINISTRATION BUILDING
451 WEST THIRD STREET
DAYTON, OHIO 45422

BID SUBMITTED BY:

(Print or Type Name of Bidder)

1. The Undersigned Bidder, having carefully reviewed the Instructions to Bidders, Drawings, Specifications and other Contract Documents for the Project entitled:

Eastern Regional Water Reclamation Facility Operations Building Renovation
PROJECT NO. 130012-59

including, having also received, read and considered the following Addenda:

Addendum No.	Date Received

and likewise having inspected the site and the conditions affecting and governing the Project and confirmed the location of the site utilities and all existing structures, the undersigned hereby proposes to furnish all materials and to perform all labor, as specified and described in the said Specifications and/or as shown on the said Drawings for all Work necessary to complete the Project on a timely basis and in accordance with the Contract Drawings regardless of whether expressly provided for in such Specifications and Drawings.

2. Before completing the Bid Form, the undersigned represents that it has carefully reviewed the Notice to Bidders, Instruction to Bidders, this Bid Form, Contractor's Affidavit (if applicable), Form of Bid and Performance/Payment Bond, Delinquent Personal Property Tax Affidavit, Contractor's Non-Collusion Affidavit, Owner-Contractor Agreement, General Conditions of the Contract (as modified), Supplementary Conditions (if any), Plans, Project Specifications, and other

Contract Documents. Failure to comply with provisions of the Contract Documents may be cause for disqualification of the Bid.

3. BONDS AND CONTRACT: If the undersigned is notified of Bid acceptance, it agrees to furnish required bonds as indicated in the Instructions to Bidders.
4. COMPLETION OF WORK: In submitting a Bid, the undersigned agrees to execute the Owner-Contractor Agreement in the form included in the Contract Documents and to Substantially Complete the Work as required by the Contract Documents.
5. The wording of the Bid Form shall be used throughout, without change, alteration or addition. Any change may cause it to be rejected.
6. Bidder is cautioned to bid only on the Brands or Standards specified in the Contract Documents, including any Addenda issued by Owner.

BID FORM
Montgomery County Eastern Regional Water Reclamation Facility Operations Building Renovations
PROJECT NO. 130012-59

Include the cost of all labor and materials for each Bid Item in the Unit Price Sheet below. Bidder is to fill in all blanks in the Unit Price Sheet related to the Bid Package.

Bid Item No.	Bid Item Description	Estimated Quantity (A)	Units (B)	Unit Cost			Bid Item Total Cost (F) (F=A x E)
				Labor (C)	Materials (D)	Combined Unit Price (E)	
1	Base Bid						
Bidder's Total Price =							

In the event there are any mathematical errors in the Bidder's calculation of the Bidder's Total Price, the sum of the Bid Item Cost in Column "E," or the Combined Unit Price(s) in Column "D," the Base Bid amount will be determined in accordance with the Instructions to Bidders.

INSTRUCTIONS FOR SIGNING

1. The person signing for a sole proprietorship must be the sole proprietor or his/her authorized representative. The name of the sole proprietor must be shown below.
2. The person signing for a partnership must be a partner or his/her authorized representative.
3. The person signing for a corporation must be the president, vice president, or other authorized representative; or must show authority by affidavit to bind the corporation.
4. The person signing for some other form of legal entity must show his/her authority, by affidavit, to bind the legal entity.

BIDDER CERTIFICATIONS

The Bidder hereby acknowledges to the Owner that the following representations in this Bid are material and not mere recitals:

1. The Bidder acknowledges that this is a public project involving public funds and that the Owner expects and requires that each Successful Bidder adhere to the highest ethical and performance standards. The Bidder by submitting its Bid pledges and agrees that (a) it will act at all times with absolute integrity and truthfulness in its dealings with the Owner and the Design Professional, (b) it will use its best efforts to cooperate with the Owner and the Design Professional and all other Contractors on the Project and at all times will act with professionalism and dignity in its dealings with the Owner, Design Professional and other Contractors, (c) it will assign only competent supervisors and workers to the Project, each of whom is fully qualified to perform the tasks that are assigned to him/her, and (d) it has read, understands and will comply with the terms of the Contract Documents.
2. The Bidder represents that it has had a competent person carefully and diligently review each part of the Contract Documents, including the Divisions of the Specifications and parts of the Drawings that are not directly applicable to the Work on which the Bidder is submitting its Bid. By submitting its Bid, each Bidder represents and agrees, based upon its careful and diligent review of the Contract Documents, that it is not aware of any conflicts, inconsistencies, errors or omissions in the Contract Documents for which it has not notified the Design Professional in writing at least seven (7) days prior to the Bid opening. If there are any such conflicts, inconsistencies, errors or omissions in the Contract Documents, the Bidder (i) will provide labor, equipment or materials of the better quality or greater quantity of Work; and/or (ii) will comply with the more stringent requirements. The Bidder will not be entitled to any additional compensation for any conflicts, inconsistencies, errors or omissions that would have been discovered by such careful and diligent review, unless it has given such prior written notice to the Design Professional.
3. The Bidder represents that it has had a competent person carefully and diligently inspect and examine the entire site for the Project and the surrounding area, including all parts of the site applicable to the Work for which it is submitting its Bid, including the location, condition and layout of the site and the location of utilities, and carefully correlate the results of the inspection with the requirements of the Contract Documents. The Bidder agrees that its Bid shall include all costs attributable to site and surrounding area conditions that would have been discovered by such careful and diligent inspection and examination of the site and the surrounding area, and the Bidder shall not be entitled to any Change Order, additional compensation, or additional time on account of conditions that could have been discovered by such an investigation.

4. The Bidder represents, understands and agrees that (a) the Claim procedures in the General Conditions are material terms of the Contract Documents, (b) if it has a Claim, it will have its personnel provide complete and accurate information to complete and submit the Statement of Claim form on a timely basis, (c) the proper completion and timely submission of a Statement of Claim form is a condition precedent to any change in the Contract Sum or the Contract Time(s), and (d) the proper and timely submission of the Statement of Claim form provides the Owner and the Design Professional with necessary information so that the Owner may investigate the Claim and mitigate its damages.
5. The Bidder represents that the Bid contains the name of every person interested therein and is based upon the Standards specified in the Contract Documents.
6. The undersigned Bidder offers and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Bid Price and within the Bid Times indicated in this Bid and in accordance with other terms and conditions of the Contract Documents. If the Bidder does not execute the Contract Form for any reason, other than as authorized by law, the Bidder and the Bidder's surety are liable to the Owner.
7. Bidder accepts all of the terms and conditions of the Notice to Bidders and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for sixty (60) days after the day of Bid opening. Bidder will sign and deliver the required number of counterparts of the Agreement with the bonds and other documents required by the Contract Forms within ten (10) days after the date of Owner's Notice of Award.
8. If the undersigned is notified of Bid acceptance, it agrees to furnish required bonds as indicated in the Instructions to Bidders.
9. In submitting this Bid, Bidder represents, as more fully set forth in the Agreement, that:
 - a. Bidder is familiar with and is satisfied as to all federal, state and local laws and regulations that may affect cost, progress, performance and furnishing of the Work.
 - b. Bidder acknowledges that Owner and Design Professional do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Contract Documents with respect to Underground Facilities at or contiguous to the site. Bidder has obtained and carefully studied (or assumes responsibility for having done so) all such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by Bidder and safety precautions and programs incident thereto and has included all such in the Bid. Bidder does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the determination of this Bid for performance and furnishing of the Work in accordance with the times, price and other terms and conditions of the Contract Documents.
 - c. Bidder is aware of the general nature of Work to be performed by Owner and others at the site, if any, that relates to Work for which this Bid is submitted as indicated in the Contract Documents.

- d. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies and data with the Contract Documents.
- e. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any person, firm or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.
- f. The Bidder certifies that upon the award of a Contract, the Contractor will ensure that all of the Contractor's employees, while working on the Project site, will not purchase, transfer, use or possess illegal drugs or alcohol or abuse prescription drugs in any way.
- g. The Bidder agrees to furnish any information requested by the Design Professional or the Owner's authorized representative to evaluate that the Bidder is the lowest and best bidder and that the Bid is responsive to the specifications.
- h. The Bidder certifies that it has no unresolved findings for recovery issued by the Auditor of State.
- i. The Bidder certifies that it is aware of and in compliance with the requirements of Ohio Revised Code Section 3517.13 regarding campaign contributions.

In accordance with the above understandings and agreements, Bidder will complete the Work for the Bid Amount, including any accepted alternates, as submitted by Bidder in this Bid Form (Specification Section 00400).

Bidder agrees that the Contract Time for the Work shall be as stated in the Agreement unless the period for completion is extended in accordance with the Contract Documents.

Bidder accepts the provisions of the Contract Documents as to liquidated and special damages in the event of failure to complete the Work on time.

The following documents are attached to and made a condition of this Bid:

1. Bid security in the amount of _____

 Dollars and _____ Cents (\$ _____)
2. Bidder's Qualification Statement with supporting data
3. Drug-free Workplace Compliance Affidavit Form
4. Disclosure Policy

The terms used in this Bid, which are defined in the General and Supplementary Conditions, have the meanings assigned to them in the General and Supplementary Conditions.

Respectfully submitted on _____, 20_____.

LEGAL NAME OF BIDDER: _____

BIDDER is: _____
(sole proprietorship, partnership, corporation, other legal entity)

NAME AND TITLE OF PERSON LEGALLY AUTHORIZED TO BIND BIDDER TO A CONTRACT

(Signature)

(Printed or Typed Name of Individual)

Business Address: _____

Phone No.: _____

Federal Tax I.D. # _____

NOTE: When the Bidder is a partnership or joint venture, state name and address of each partner in the partnership or each participant in the joint venture below:

Name

Address

Name

Address

Name

Address

BIDDER'S AFFIDAVIT

(To be filled in and executed if Bidder is a Corporation)

COUNTY OF _____)
)ss:
STATE OF _____)

_____, being duly sworn, deposes and
(Affiant)

says that he is _____ of _____ a Corporation
(Title) (Name of Corporation)

organized and existing under and by virtue of the laws of the State of _____,
(State)

and having its principal office at

(Street and Number) (City)

(County) (State)

Affiant further says that he is familiar with the records, minute books

and by-laws of _____.
(Name of Corporation)

Affiant further says that _____
(Officer's Name)

as _____ of the Corporation, is duly
(Officer's Title)

authorized to sign the Contract for _____

_____, for said

Corporation by virtue of _____
(State whether a provision of by-laws or a Resolution of the Board of

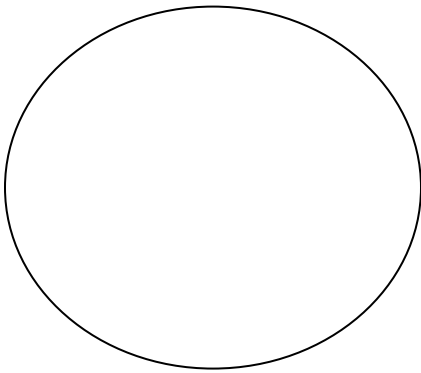
Directors and if by Resolution, give date of adoption)

Signed: _____
(Affiant)

Typed or printed name _____

Title: _____

Sworn to and subscribed in my presence this _____ day of _____, 20____.



Notary Seal

(written signature) _____

(typed or printed name) _____

Notary Public, State of Ohio
My commission expires

(month, day, year)

Montgomery County Public Improvement Qualitative Bid Selection Criteria

The following requirements shall apply to all Montgomery County public improvement bids over \$50,000. By signing the Bid Form, Bidder acknowledges and accepts the terms of this Bid Selection Criteria.

1. All Bids will be evaluated by Montgomery County and/or a Consulting Engineer or Architect based on “Lowest and Best” criteria pursuant to ORC 307.86.
2. The Successful Bidder shall furnish a notarized statement (Specification Section 00560) listing any delinquent taxes and must not be on the State of Ohio Auditor’s Office Finding for Recovery database in compliance with ORC 5719.042.
3. The Successful Bidder shall furnish a valid BWC Certificate covering all employees. All prime contractors must insure that all subcontractors maintain current BWC Certification for all employees.
4. Bidder shall disclose any Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA) or other regulatory entity issues, citations, or violations in the last seven (7) years.
5. Bidder shall disclose whether it plans to utilize independent contractors on the Project.
6. If the Bidder is a foreign corporation, i.e. not incorporated under the laws of Ohio, it shall furnish a Certificate of Good Standing from the Ohio Secretary of State showing the right of the Bidder to do business in the State. If the Bidder is an individual or partnership, the Bidder shall certify it has filed, with the Ohio Secretary of State, a Power of Attorney designating the Ohio Secretary of State as the Bidder’s agent for the purpose of accepting service of summons in any lawful legal action.
7. The Bidder, upon award, shall supervise and direct the Work using their best skill and attention commensurate with the responsibility to provide a satisfactory product.
8. The Bidder, upon award, shall not permit employment of person not skilled in tasks assigned. Only qualified personnel shall survey, lay out and construct the Work.
9. The Successful Bidder, within ten (10) days after award of the Contract, shall furnish in writing, to Montgomery County, the names of person or entities (including those who are to furnish materials or equipment fabricated to special design) proposed for each principal portion of the Work. The Board will promptly relay to the Successful Bidder in writing stating whether or not the Board, after due investigation, has any objection to any such proposed person or entity.
10. Bidder shall disclose any determination made by Ohio Department of Commerce, Bureau of Wage & Hour that it made an underpayment to its employees as required by Ohio’s prevailing wage law, whether the underpayment occurred intentionally or unintentionally, or whether the underpayment was settled subsequent to the finding, over the past seven (7) years.
11. Bidder shall certify all of the following as requirements for Bid acceptance:

- a. For projects that are classified as prevailing wage, Bidder certifies compliance with Ohio Department of Commerce Division of Industrial Compliance regulations as provided in ORC Chapter 4115 and OAC Chapter 4101:9-4. Any violations of these regulations for the previous five (5) years shall be disclosed by the Bidder in their Bid packet.
- b. Bidder certifies it has complied with unemployment and workers' compensation laws for at least the twelve (12) months preceding the date of Bid opening.
- c. Bidder certifies compliance with Ohio Drug Free Workplace in accordance with ORC 153.03 at the time of its Bid submission. If Bidder has known subcontractors at the time of its Bid, it must certify those subcontractors are in compliance with ORC 153.03.
- d. Bidder certifies that it offers a health care medical plan and a retirement program other than Social Security to their employees.
- e. Bidder certifies it will employ supervisory personnel on this Project that have three (3) or more years in the specific trade and/or maintain the appropriate state licensure, if any.
- f. Bidder certifies within the past five (5) years, neither the Bidder, nor any principal, owners, officer, major stockholder (10% or more of voting share for publicly traded companies, 25% or more for all other companies), affiliates or any person involved in the bidding, contracting or leasing process has been the subject of any administrative proceeding, civil action, sanction, judgement or conviction for any business-related conduct constituting a crime under federal, state or local law including, but not limited to, fraud, extortion, bribery, racketeering, price-fixing or bid collusion or any crime related to truthfulness and/or business conduct.
- g. Bidder certifies that it has a valid Contractor license or registration required to do the work in the State of Ohio and any appropriate subdivisions of the State and furnish proof of all such licenses.
- h. Bidder certifies it has not had a professional license revoked in the past five (5) years in Ohio or any other state.
- i. Bidder certifies it has implemented a safety program compliant with OSHA and all other laws and regulations and will provide evidence of such upon request.

12. The following shall be Montgomery County's rights for Bid acceptance:

- a. Montgomery County may reject any or all Bids, may waive any or all informalities, irregularities or clerical errors not involving price, time, or changes in the Work, and may reject all nonconforming, nonresponsive or conditional Bids.
- b. Montgomery County may reject any Bid not accompanied by specified documentation and Bid security.
- c. Montgomery County may reject any Bid if it shows any omissions, alterations of forms, additions not called for, conditions or qualifications or irregularities of any kind.

- d. Montgomery County may reject any Bid that, in its sole discretion, is considered to be unbalanced or unreasonable as to the amount bid for any lump sum or unit price item.
- e. In evaluating Bids, Montgomery County will consider the qualifications and experience of Bidders; whether or not the Bids comply with the prescribed requirements; the alternatives, if any; the time(s) for completion as stated in the Bid Form and the lump sum and unit prices, if request in the Bid Form.
- f. Montgomery County may consider the qualification and experience of subcontractors, suppliers and other persons and organizations (including those who are to furnish the principal items of material or equipment) proposed for those portions of the Work as to which the identity of subcontractors, suppliers and other persons and organizations must be submitted as provided in the Supplementary Conditions.
- g. Montgomery County may conduct such investigation necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of the Bidders, proposed subcontractors, suppliers and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents. Montgomery County reserves the right to reject the Bid of any Bidder who does not pass any such evaluation to Montgomery County's satisfaction.

Any questions regarding this criterion should be directed to the Barbara Asberry, Senior Buyer, at asberryb@mcOhio.org. All questions must be submitted in writing.

By signing the Bid Form, Bidder certifies that Bidder acknowledges and accepts the preceding criteria as conditions of Bid acceptance.

END OF SECTION

SECTION 00410

BID AND PERFORMANCE/PAYMENT BOND
(Sec. 153.571 Ohio Revised Code)

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned

_____ (“Contractor”) as

Principal, and _____ as Surety, are hereby held and firmly bound unto the Board of County Commissioners of Montgomery County, Ohio (hereinafter called the “Obligee”), in the penal sum of the dollar amount of the Bid submitted by the Principal to the Obligee on _____, 20____, to undertake the project known as the Eastern Regional Water Reclamation Facility Operations Building Renovation Project (“Project”).

The penal sum referred to herein shall be the dollar amount of the Principal's Bid to the Obligee, incorporating any additive or deductive Alternates made by the Principal on the date referred to above to the Obligee, which are accepted by the Obligee. In no case shall the penal sum exceed the amount of _____ dollars (\$_____).

(If the foregoing blank is not filled in, the penal sum will be the full amount of the Principal's Bid, including add Alternates. Alternatively, if the blank is filled in, the amount stated must not be less than the full amount of the Bid, including add Alternates, in dollars and cents. A percentage is not acceptable.) For the payment of the penal sum well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH that whereas the above-named Principal has submitted a Bid for work on the Project.

NOW, THEREFORE, if the Obligee accepts the Bid of the Principal and the Principal fails to enter into a proper contract in accordance with the Bid, plans, details, specifications, and bills of material; and in the event the Principal pays to the Obligee the difference not to exceed ten percent (10%) of the penalty hereof between the amount specified in the Bid and such larger amount for which the Obligee may in good faith contract with the next lowest Bidder to perform the work covered by the Bid; or in the event the Obligee does not award the contract to the next lowest Bidder and resubmits the project for bidding, the Principal pays to the Obligee the difference not to exceed ten percent (10%) of the penalty hereof between the amount specified in the Bid, or the costs, in connection with the resubmission, of printing new contract documents, required advertising and printing and mailing notices to prospective Bidders, whichever is less, then this obligation shall be void, otherwise to remain in full force and effect. If the obligee accepts the Bid of the Principal and the Principal within ten (10) days after the awarding of the contract, enters into a proper contract in accordance with the Bid, plans, details, specifications, and bills of material, which said contract is made a part of this bond the same as though set forth herein.

NOW ALSO, IF THE SAID Principal shall well and faithfully do and perform the things agreed by said Principal to be done and performed according to the terms of said contract; and shall pay all lawful claims of subcontractors, materialmen, and laborers, for labor performed and materials furnished in the carrying forward, performing, or completing of said contract; we agreeing and assenting that this undertaking shall be for the benefit of any materialman or laborer having a just claim, as well as for the Obligee herein, then this obligation shall be void; otherwise the same shall remain in full force and effect; and Surety shall indemnify the Obligee against all damage suffered by failure of the Principal to perform the contract according to its provisions and in accordance with the plans, details, specifications, and bills of material therefor and to pay all lawful claims of subcontractors, materialmen, and laborers for labor performed or material furnished in carrying forward, performing, or completing the contract and surety further agrees and assents that this undertaking is for the benefit of any subcontractor, materialman, or laborer having a just claim, as well as for the Obligee; it being expressly understood and agreed that the liability of the Surety

for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

THE SAID Surety hereby stipulates and agrees that no modifications, omissions, or additions, in or to the terms of the said contract or in or to the plans and specifications therefor shall in any wise affect the obligations of said Surety on this bond, and it does hereby waive notice of any such modifications, omissions or additions to the terms of the contract or to the work or to the specifications.

SIGNED AND SEALED this _____ day of _____, 20 _____ .

PRINCIPAL: _____

BY: _____
(Signature)

(Typed or Printed Name)

TITLE: _____

SURETY: _____

BY: _____
(Attorney/Attorney-in-Fact Signature*)

(Typed or Printed Attorney/Attorney-in-Fact Name*)

* Attach certified and effective dated copy of power of attorney showing authority of attorney-in-fact to execute in behalf of corporation.

Sec. 9.32 of the Ohio Revised Code requires awarding authorities to simultaneously with notice of award to contractor, to give written notice to Surety and Agent. Show name and mailing addresses of both Agent and Surety.

SURETY COMPANY ADDRESS:

SURETY AGENT'S NAME
AND ADDRESS:

NOTE: The Contract Bond form that follows is to be used ONLY by a Bidder that is awarded a contract and submits a form of bid guaranty other than the combined Bid Guaranty and Contract Bond with its Bid. If a Bidder submits a combined Bid Guaranty and Contract Bond, then the Bid guaranty becomes the contract bond when the contract is awarded.

AIA Bid Bond or Payment and Performance Bond forms are not acceptable for this Project.

END OF SECTION

SECTION 00420

BIDDER'S QUALIFICATION STATEMENT

(Completion of this statement is required and must be submitted with the Bid in order to qualify for consideration for award of contract.)

SUBMITTED TO:

BOARD OF COUNTY COMMISSIONERS
MONTGOMERY COUNTY, OHIO
MONTGOMERY COUNTY ADMINISTRATION BUILDING
451 WEST THIRD STREET
DAYTON, OHIO 45422

SUBMITTED FOR:

MONTGOMERY COUNTY, OHIO
Eastern Regional Water Reclamation Facility Operations Building Renovation
PROJECT NO. 130012-59

SUBMITTED BY:

Name: _____

Address: _____

- ☐ Corporation
- ☐ Partnership
- ☐ Individual/Sole Proprietorship
- ☐ Joint Venture
- ☐ Other

Commissioners:

The undersigned certifies under oath the truth and correctness of all statements and of all answers to questions made hereinafter.

(Note: Attach Separate Sheets as Required)

1. ORGANIZATION

- a. How many years has your organization been in business as a contractor?

- b. How many years has your organization been in business under its present name?

- c. Under what other or former names has your organization operated?

- d. If your organization is operating under a trade name registration with the Secretary of State for the State of Ohio, identify the entity for which the trade name is registered. If none, state "none."

2. If your organization is a corporation, answer the following:

- a. Date of incorporation: _____
- b. State of incorporation: _____
- c. President's name: _____
- d. Vice President's name(s): _____
- e. Secretary's name: _____
- f. Treasurer's name: _____

3. If your organization is a partnership, answer the following:

- a. Date of organization: _____
- b. Type of partnership (if applicable): _____
- c. Name(s) of general partner(s): _____

4. If your organization is individually owned, answer the following:

- a. Date of organization: _____
- b. Name of owner: _____

5. If the form of your organization is other than those listed above, describe it and name the principals:

If your organization is a division or wholly-owned subsidiary of another entity or has another relationship with another entity, identify the entity of which it is a division or wholly-owned subsidiary or with which it has another relationship and also identify the nature of the relationship. If none, state "not applicable."

6. LICENSING

- a. List jurisdictions and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable.

- b. List jurisdictions in which your organization's partnership or trade name is filed.

7. EXPERIENCE

- a. List the categories of work that your organization normally performs with its own forces.

- b. Has any construction contract to which you have been a party been terminated by the owner; have you ever terminated work on a project prior to its completion for any reason; has any surety which issued a performance bond on your behalf ever completed the work in its own name or financed such completion on your behalf; has any surety expended any monies in connection with a contract for which they furnished a bond on your behalf? If the answer to any portion of this question is "yes", please furnish details of all such occurrences including name, address, phone number, and contact person of owner, architect or engineer, and surety, and name and date of project.

No _____

Yes _____, If yes, attach details described above.

- c. Has any officer or partner of your organization ever been an officer or partner of another organization that had any construction contract terminated by the owner; terminated work on a project prior to its completion for any reason; had any surety which issued a performance bond complete the work in its own name or financed such completion; or had any surety expend any monies in connection with a contract for which they furnished a bond? If the answer to any portion of this question is "yes", please furnish details of all such occurrences including name, address, phone number, and contact person of owner, architect or engineer, and surety, and name and date of project.

No _____

Yes _____, If yes, attach details described above.

- d. Within the last five (5) years, has your organization or any of its officers prosecuted any Claim, had any Claims prosecuted against it or them, or been involved in or is currently involved in any mediation or arbitration proceedings or lawsuits related to any construction project, or has any judgments or awards outstanding against it or them?

No _____

Yes _____, If the answer is yes, please attach the details for each Claim, including the names and telephone numbers of the persons who are parties, the amount of the Claim, the type of Claim and basis for the claim, and the outcome.

Note: As used in this document “Claim” means a Claim initiated under the Contract Documents for a project.

- e. List construction projects your organization has in progress at this time, giving the name of project, contact name and its telephone number, original contract amount, percent complete and scheduled completion date.

Project Name	Contact Name and Phone Number	Original Contract Amount	Percent Complete	Scheduled Completion Date

- f. Provide the following information for each project your organization has had during the last five (5) years, which your organization believes is of comparable or greater size and complexity than Owner's project. If there are more than ten (10) of these projects, only provide information on the most recent ten (10) projects, including current projects.

Project Name	Final Contract Amount	Owner's Name and Phone Number	Design Professional's Contact Name and Phone Number	Project Completion Date

- g. State average annual amount of construction work your organization has performed during the last five years.

- h. If any of the following members of your organization's management—president, chairman of the board, or any director—operates or has operated another construction company during the last five (5) years, identify the member of management and the name of the construction company.

- i. List the construction education, training, and construction experience for each person who will fill a management role on the Project, including without limitation the Project Executive, Project Architect, Project Manager, and Project Superintendent. For each person listed, include with the other information the last three projects on which the person worked and the name and telephone number of the Design Professional and Owner of each project.

- j. List name and construction experience of the principal individuals of your organization.

8. REFERENCES

List name, address and telephone number of an individual who represents each of the following and whom OWNER may contact for a financial reference:

- a. A surety:
Name _____
Contact _____
Address _____
Phone No. _____
Financial Reference _____
- b. A bank:
Name _____
Contact _____
Address _____
Phone No. _____
Financial Reference _____

- c. A major material supplier:
Name _____
Contact _____
Address _____
Phone No. _____
Financial Reference _____

9. FINANCING

- a. Attach a financial statement, preferably audited, including your organization's latest balance sheet and income statement showing the following items:
- Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses)
- Net Fixed Assets;
- Other Assets;
- Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries and accrued payroll taxes); and
- Other Liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings).
- b. Name and address of firm preparing attached financial statement, and date thereof.
- c. Is the attached financial statement for the same organization named on page one?
- d. If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsidiary).
- e. Will the organization whose financial statement is attached act as a guarantor of the contract for construction?

CERTIFICATION. The undersigned certifies for the reliance of the Owner that after diligent investigation, to the best of the undersigned's belief, the information provided with this Contractor's Qualification Statement is true, accurate, and not misleading.

Dated at _____, this _____ day of _____, 20____.

Name of organization: _____

By: _____

Signature: _____

Title: _____

SEAL

_____, being duly sworn, deposes and says that the information provided herein is true and sufficiently complete so as not to be misleading.

Subscribed and sworn before me this _____ day of _____, 20____.

NOTARY PUBLIC

My Commission Expires: _____

END OF SECTION

SECTION 00450

DRUG-FREE WORKPLACE COMPLIANCE AFFIDAVIT FORM
(O.R.C. § 153.03 - § 153.031)

I, _____, the _____ of _____
(name) (title) (corporation/company name)
on behalf of said corporation/company and in accordance with O.R.C. § 153.03 and
§ 153.031, hereby swear and certify that _____ is enrolled
(corporation/company name)
and in good standing with the Ohio Bureau of Workers' Compensation Drug-Free
Workplace Program, or in a comparable program, called _____,
(name of comparable program)
which has been approved by the Bureau of Workers' Compensation.

I further certify and acknowledge that _____ understands
(corporation/company name)
that this compliance form shall be incorporated into and become a part of the contract
between the public contracting authority and _____, as
(corporation/company name)
Contractor, if the said corporation/company is the Successful Bidder on the
_____ Project.
(name of Project)

The Contractor hereby additionally certifies, agrees, and acknowledges that it is
hereby contractually responsible to the public contracting authority for taking whatever
measures are legally necessary to ensure that its Subcontractors, and any subsequent
tier of Subcontractors, are also enrolled and in good standing with the Ohio Bureau of
Workers' Compensation Drug-Free Workplace Program, or with a comparable Bureau
approved program, prior to the provision of any labor on the _____
(name of Project)
Project by any Subcontractor of any tier.

Further Affiant Sayeth Naught.

(signature of Affiant)

(printed or typed name of Affiant)

For: _____
(name of corporation/company/contractor)

Its: _____
(title of Affiant)

STATE OF _____)
) SS:
COUNTY OF _____)

Sworn to and subscribed before me, a Notary Public in and for the State of _____, on this _____ day of _____, _____ by _____
_____ as his/her voluntary act and deed.
(Affiant)

Notary Public

END OF SECTION

SECTION 00491

DISCLOSURE POLICY

The Board of County Commissioners of Montgomery County, Ohio, has adopted a disclosure policy which requires persons or business contracting with the Board of County Commissioners of Montgomery County, Ohio, to disclose to the Board any business and/or family relationship which the contracting party has with any public official, or person employed by any public official in Montgomery County, Ohio. Immediate family relationships, for disclosure purposes, is defined as spouse; children; parents (natural and by-law); and siblings (natural and by-law). Disclosure of this information will not necessarily preclude the award of a contract to the undersigned. The undersigned party, in accordance with intent of Resolution No. 88-1276 adopted by the Board of County Commissioners, Montgomery County, Ohio on July 6, 1988, agrees to disclose, to the best of its knowledge and ability, the following information:

CORPORATION

The identity of any county official, county employee, or member of a county official or county employee's immediate family, who hold(s) a position of responsibility being defined as position having decision making capacities including but not limited to a member of the board of directors, officer of the corporation, or trustee;

PARTNERSHIP

The identification of person(s) employed by the partnership and or the names(s) of any of the immediate family who is, or who are, also simultaneously employed by a public official of Montgomery County, Ohio, or public office or agency of Montgomery County, Ohio;

CONSULTANT

The identification of person(s) employed by the consultant and or name(s) of the consultant's immediate family who is, or who are, also simultaneously employed by any official of Montgomery County, Ohio, or public office or agency of Montgomery County, Ohio.

JOINT VENTURE

The identity of individuals of corporations, partnerships or consultants as defined above of which said corporations, partnerships or consultants are a party of a joint venture.

Should the undersigned party have knowledge or information concerning the above categories, the undersigned party is to submit this acknowledgement form with a detailed explanation of the names of the parties involved and the particular relationship. Please check the appropriate box.

☐ DOES NOT APPLY

☐ DOES APPLY AND EXPLANATION
ATTACHED

SIGNATURE _____ SIGNATURE _____

TITLE _____ TITLE _____

END OF SECTION

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SECTION 00500

NOTICE OF AWARD

TO: _____

You are hereby notified that the Board of County Commissioners, Montgomery County, Ohio, herein called OWNER, has reviewed all Bids submitted for the construction of

Eastern Regional Water Reclamation Facility Operations Building Renovation

PROJECT NO. 130012-59

in accordance with the Contract Documents and that your Bid in the amount of

_____ Dollars (\$_____) is the apparent lowest and best Bid for the Project and that OWNER intends to execute the Agreement for this Work, provided, however, that you first comply with the obligations of the Successful Bidder set forth in the Instructions to Bidders and subject to the provisions of the form of OWNER-Contractor Agreement enclosed herewith and the proper, punctual execution thereof by you. Acceptance by the OWNER is conditioned upon approval of the Agreement by resolution and your compliance with the obligations identified herein. Prior to approval of the Agreement by resolution, OWNER reserves the right to refrain from entering into or to rescind the award of the Contract in accordance with the Contract Documents for the Project, which includes, but is not limited to your failure to fulfill the obligations identified herein within the respective times specified.

Also enclosed for your execution are the following forms: 1) Contract Bond, if Bid and Performance/Payment Bond was not included with the Bid; and, 2) and Non-Collusion Affidavit (Principal Contractor and Subcontractor). These documents shall be executed and dated by you and your Surety and returned within ten (10) calendar days to OWNER at the address listed below. CONTRACTOR shall also deliver bonds, insurance certificates and Workers' Compensation Certificate to OWNER as stated in the General Conditions, including paragraph 2.01 of the General Conditions.

MONTGOMERY COUNTY ENVIRONMENTAL SERVICES
1850 SPAULDING ROAD
DAYTON, OHIO 45432
Attn: Shawn D. Bailey
Project Manager

Subsequent to execution of the Agreement by OWNER, the required number of copies of the Agreement and Escrow Agreement will be provided to you for your signature.

Date: _____, 20____

By _____

Title

In accordance with the Ohio Revised Code Section 9.32, "Notice to Sureties", this Notice of Award is also being sent to the following agencies:

SURETY:

SURETY AGENT:

END OF SECTION

SECTION 00510

AGREEMENT

BOARD OF COUNTY COMMISSIONERS

MONTGOMERY COUNTY, OHIO

Eastern Regional Water Reclamation Building Renovation

PROJECT NO. 130012-59

THIS AGREEMENT is dated as of the _____ day of _____ in the year 20____, by and between the Board of County Commissioners, Montgomery County, Ohio, Montgomery County Administration Building, 451 West Third Street, Dayton, Ohio, 45422, (hereinafter called OWNER) and _____ (hereinafter called CONTRACTOR).

WITNESSETH: OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE 1 – CONTRACT DOCUMENTS

1.01 *The Contract Documents consist of the following documents:*

- A. Notice to Bidders (00020);
- B. Instructions to Bidders (00100);
- C. Bid Form (00400);
- D. Bid and Performance/Payment Bond (00410);
- E. Performance/Payment Bond (Used in lieu of “D” with an accepted security from “F”) (00512);
- F. Certified Check, Letter of Credit, or Cashier’s Check;
- G. Bidders Qualification Statement (00420);
- H. Drug-Free Workplace Compliance Affidavit Form (00450);
- I. Disclosure Policy (00491);
- J. Notice of Award (00500);
- K. Agreement (00510);
- L. Escrow Agreement (00511);
- M. Notice to Proceed (00520);
- N. Delinquent Personal Property Tax Affidavit (O.R.C. 5719.042) (00560);
- O. Non-Collusion Affidavit (Principal Contractor) (00561);
- P. Non-Collusion Affidavit (Subcontractor) (00562);

- Q. Drawings;
- R. Specifications, including the Montgomery County Environmental Services Standard Specifications and all Supplemental Specifications;
- S. The "Montgomery County Environmental Services Rules and Regulations," hereinafter abbreviated the MCRR, their latest edition;
- T. Other applicable specifications such as the City of Kettering (CKS), and the Project Specific Contract Documents;
- U. Addenda issued;
- V. Construction Contract Exemption Certificate (00663);
- W. Prevailing Wages Affidavit of Contractor (00670);
- X. Contractor's Payment Application Checklist (00679);
- Y. Contractor's Affidavit with List of Subcontractors and Suppliers (00680);
- Z. Contractor's Waiver & Release Affidavit ("Affidavit") (00681);
- AA. Subcontractors, Suppliers Waiver & Release Affidavit ("Affidavit") (00682);
- BB. Modifications issued after the execution of the contract, including:
 - 1. Written Field Order for a minor change of the Work issued by the DESIGN PROFESSIONAL in accordance with the General Conditions (00684);
 - 2. Work Change Directive; or,
 - 3. Change Order (00685).
- CC. Certificate of Substantial Completion (00686)
- DD. Statement of Claim Form (00687);
- EE. Consent of Surety Form (00688);
- FF. General Conditions of the Contract for Construction EJCDC C-700, as modified (00700);
- GG. Supplemental Conditions of the Contract (00800);
- HH. Prevailing Wage Rates (00830);
- II. Certificate(s) of Insurance;
- JJ. State of Ohio Bureau of Workers' Compensation Insurance Certificate;
- KK. Notice of Commencement of Public Improvement(00530);
- LL. Payroll Information;
- MM. Final Payroll Affidavit;

- 1.02 *Non-Contract Documents. The following are the reports and tests of subsurface conditions at or contiguous to the Site, if any, that the DESIGN PROFESSIONAL has used in preparing the Contract Documents. These are not Contract Documents. The General Conditions, as modified, contain additional terms related to these reports and tests. (None if none are listed).*
- 1.03 *Non-Contract Documents. The following are those reports and drawings related to any Hazardous Conditions at the Site, if any. These are not Contract Documents. The General Conditions, as modified, contain additional terms related to these reports and drawings. (None if none are listed).*

A. Limited Hazardous Building Material Inspection Report

By Lawhon & Associates, Inc.

September 24, 2024

ARTICLE 2 – THE WORK

CONTRACTOR shall at his own cost and expense furnish all labor, services, tools, materials, equipment and incidentals necessary to perform all Work required by the Contract Documents to construct Project No. 130012-59, Eastern Regional Water Reclamation Building Renovation

2.01 at Montgomery County, Ohio, in complete accordance with the Contract Documents. The Work under the Contract Documents is generally described in Section S-01011 as appropriate of the General Requirements.

2.02 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

This project involves the comprehensive renovation of the Eastern Regional Water Reclamation Operations Building. The renovation will span two floors and encompass a variety of critical infrastructure and aesthetic improvements. Consisting of HVAC, plumbing, electrical, structural, along with some landscaping and remodeling.

ARTICLE 3 – DESIGN PROFESSIONAL

The Contract Documents shall not be construed to create a contractual relationship of any kind between the DESIGN PROFESSIONAL and the CONTRACTOR or any subcontractor or Material Supplier to the Project. The DESIGN PROFESSIONAL, however, shall be entitled to performance of the obligations of the CONTRACTOR intended for its benefit and to enforcement of such obligations, but nothing contained herein shall be deemed to give the CONTRACTOR or any third party any claim or right of action against the DESIGN PROFESSIONAL that does not otherwise exist without regard to this Contract. The CONTRACTOR and its subcontractors shall not be deemed to be beneficiaries of any of the acts or services of the DESIGN PROFESSIONAL that are performed for the sole benefit of the OWNER. The CONTRACTOR shall forward all communications to the OWNER through the DESIGN PROFESSIONAL and hereby acknowledges and agrees that any instructions, reviews, advice, approvals, orders, or directives that are rendered to it by the DESIGN PROFESSIONAL are specifically authorized and directed by the OWNER to the CONTRACTOR through the DESIGN PROFESSIONAL acting on behalf of the OWNER.

3.01 The DESIGN PROFESSIONAL is:

Name: SPGB Architects LLC
Address: 4333-A Tuller Road
Dublin, Ohio 43017

The DESIGN PROFESSIONAL's Representative is Chandra Wilson, SPGB Architects, LLC.

ARTICLE 4 – CONTRACT TIMES

4.01 DATE FOR COMMENCEMENT. The Date of Commencement of the Work shall be the date identified in the Notice to Proceed issued by the OWNER to the CONTRACTOR. If such Notice to Proceed is not issued, the Date of Commencement of the Work shall be 30 days after the Effective Date of this Agreement.

4.02 The CONTRACTOR shall complete the following activities of Work within the milestone durations indicated. These milestones are as defined below and their work activity durations are calendar days after Notice to Proceed.

MILESTONE	ACTIVITY	MILESTONE WORK ACTIVITY DURATION
Milestone No. 1	Phase One Completion	180 Days
Milestone No. 2	Phase Two Completion	365 Days
Milestone No. 3	Substantial Completion	365 Days
Milestone No. 4	Contract Completion	395 Days
Milestone No. 5	Contract Expiration	455 Days

- A. Milestone No. 1: Phase One Completion. The activities associated with Milestone No. 1 include all second floor demolition and new work as shown in the drawings.
- B. Milestone No. 2: Phase Two Completion. The activities associated with Milestone No. 2 include all first floor demolition and new work as shown in the drawings.
- C. Milestone No. 3: Substantial Completion. Substantial Completion is the time at which the Work has progressed to the point where the Work is sufficiently complete, in accordance with the Contract Documents, so that the Work can be utilized for the purposes for which it is intended. The Project and Work for the Project consists of all labor, materials, equipment, and services necessary for construction of the Project, all in accordance with the Drawings and Specifications prepared by the DESIGN PROFESSIONAL. The Project shall be substantially complete on or before the Milestone Date for Substantial Completion as provided in this Agreement, or as modified by a properly executed change order.

- D. Milestone No. 4: Contract Completion. Contract Completion (also referred to as Final Completion) shall mean that the Work is complete in accordance with the Contract Documents and the CONTRACTOR has submitted to the OWNER all documents required to be submitted to the OWNER for final payment
- E. Milestone No. 5: Contract Expiration.
- 4.03 The contractual Milestone Dates shall only be changed or modified by Change Order, other Modification, or a Claim that is Finally Resolved regardless of any dates in any schedules, including the Construction Progress Schedule, created by any person, including the CONTRACTOR.
- 4.04 SHUTDOWN DATES. Due to events scheduled by the OWNER and/or other OWNER considerations, CONTRACTOR will not be able to perform Work on the Project on the following dates (there are no shutdown dates if none listed):
- CONTRACTOR's Construction Schedule for performing the Work shall account for CONTRACTOR not being able to perform Work on these dates and the contractual Milestone Dates will not be changed due to CONTRACTOR not being able to perform Work on these dates.
- 4.05 CONSTRUCTION SCHEDULE. The Construction Schedule shall be developed by the CONTRACTOR as provided in the Contract Documents.
- 4.06 COORDINATING CONTRACTOR. The Coordinating Contractor shall be the [] Contractor (if this blank is completed, then the Coordinating Contractor shall be the General Trades Contractor or, if there is only one contractor, the Contractor). The Coordinating Contractor shall be responsible for coordinating the work of all contractors on the Project.

ARTICLE 5 – LIQUIDATED DAMAGES AND SPECIAL DAMAGES

5.01 Liquidated Damages:

- A. OWNER and CONTRACTOR recognize that time is of the essence as to Contract Completion and that OWNER will suffer financial loss apart from any other damages, including, but not limited to the damages described in Paragraph 5.02, if the Work is not complete within the Contract Times specified in Article 4, plus any extensions thereof allowed in accordance with Article 11 of the General Conditions. If the CONTRACTOR does not complete its Work in accordance with the applicable Milestone date(s), the CONTRACTOR shall pay the OWNER (and the OWNER may set off from sums coming due the CONTRACTOR) Liquidated Damages in the per diem amounts as set forth below:

MILESTONE	ACTIVITY	Dollars Per Calendar Day
Milestone No. 1	Phase One Completion	\$0
Milestone No. 2	Phase Two Completion	\$0

Milestone No. 3	Substantial Completion	\$600
Milestone No. 4	Contract Completion	\$0
Milestone No. 5	Contract Expiration	\$0

- B. The CONTRACTOR acknowledges that such amounts of Liquidated Damages represent a reasonable estimate of the actual damages for loss of or interference with the intended use of the Project that the OWNER would incur if the CONTRACTOR fails to complete the Work for each Milestone within the applicable number of days for each Milestone, including any extensions thereof made in accordance with Article 11 of the General Conditions.
- C. In addition to such Liquidated Damages, the CONTRACTOR shall indemnify, defend and hold the OWNER and its employees and agents harmless from any and all claims, whether or not such claims are proven, and from all costs and expenses incurred, as a result of or related to such claims, including but not limited to attorneys' and consultants' fees and expenses, provided that such claims arise out of or are related to the CONTRACTOR's failure to meet any Milestone Dates. The CONTRACTOR's obligation to indemnify, defend and hold the OWNER harmless under this Paragraph shall be joint and several. These Liquidated Damages are in addition to any other remedies available to the OWNER under the Contract Documents.

5.02 Special Damages:

- A. In addition to the amount provided for Liquidated Damages, CONTRACTOR shall pay OWNER the actual costs reasonably incurred by OWNER for engineering and inspection forces employed on the Work for each day that expires after the time specified in Article 4 for all milestones with associated liquidated damages including the Contract Completion Milestone, including any extensions thereof made in accordance with Article 11 of the General Conditions, until the Work is complete.
- B. The amount of liquidated and special damages set forth in Article 5, Paragraphs 5.01 and 5.02 shall be assessed cumulatively. OWNER may set off from sums coming due the CONTRACTOR under this Agreement.

ARTICLE 6 – CONTRACT PRICE

- 6.01 Subject to the requirements for Unit Prices, as defined in the Contract Documents, including, but not limited to Paragraph 13.03 of the General Conditions (00700), the lump sum Contract Sum to be paid by the OWNER to the CONTRACTOR, as provided herein, for the satisfactory performance and completion of the Work and all of the duties, obligations and responsibilities of the CONTRACTOR under this Agreement and the other Contract Documents will be _____ Dollars \$ _____ as set forth in the Bid Form. The Contract Sum includes all the necessary labor, materials and equipment of every description to carry out and complete in a substantial and workmanlike manner all the items in connection with the construction of the Project, and all Work incidental thereto, in accordance with the Contract Documents. The Contract Sum includes all federal, state, county, municipal, and other taxes imposed by law, including but not limited to any sales, use, and personal property taxes payable by or levied against the CONTRACTOR on account of the Work or the materials

incorporated into the Work. The CONTRACTOR will pay any such taxes. The Contract Sum includes the following:

Base Bid Amount: \$ _____

- 6.02 LIMITATION ON LIABILITY. The OWNER's total liability under this Agreement will be limited to the amount set forth in the Fiscal Officer's certificate accompanying this Agreement. Under no circumstances will the elected officials, officers, employees, board members, or agents of the OWNER be personally liable for any obligations or claims arising out of or related to this Agreement.
- 6.03 RETAINAGE. Retainage applicable to the Contract by Ohio Revised Code Sections 153.12, .13, and .14 will be withheld as defined in the General Conditions.

ARTICLE 7 – PAYMENT PROCEDURES

- 7.01 CONTRACTOR shall submit Applications for Payment in accordance with Article 15 of the General Conditions and as amended by the Supplementary Conditions. Applications for Payment will be processed as provided in the General Conditions and as amended by the Supplementary Conditions.
- 7.02 Progress Payments:
- A. OWNER shall make monthly progress payments on account of the Contract Price on the basis of CONTRACTOR's Applications for Payment as recommended by DESIGN PROFESSIONAL. CONTRACTOR's Applications for Payment will be due on the day of the month agreed upon by the OWNER and CONTRACTOR. All progress payments will be on the basis of the progress of the Work measured by the schedule of values provided for in Paragraph 15.01 of the General Conditions.
1. Progress payments will be made in accordance with Section 153.12 of the Ohio Revised Code.
2. OWNER shall retain an amount in accordance with Sections 153.12, 153.13, 153.14 and 153.63 of the Ohio Revised Code. The retained funds will be paid 30 days from the date of the Final Estimate or acceptance if the Contract has been faithfully performed, whichever is later.
- 7.03 Final Payment:
- A. Upon final completion and acceptance of the Work in accordance with the Contract Documents, including, but not limited to Paragraph 15.06 of the General Conditions and the Supplementary Conditions, OWNER shall pay the remainder of the Contract Price as recommended by DESIGN PROFESSIONAL.

ARTICLE 8 – INTEREST

- 8.01 All moneys not paid when due hereunder as allowed by the Ohio Revised Code and stated in the Agreement shall be deposited in a joint escrow account with the OWNER and the CONTRACTOR required to co-sign for any withdrawals. The savings institution shall be selected by the CONTRACTOR. The savings institution shall be an Ohio Banking Association

organized and existing under the laws of the State of Ohio and acceptable to the OWNER. The type of account shall be selected by the CONTRACTOR. All interest and principal arising from moneys due the CONTRACTOR shall be paid to him upon completion of the Contract in accordance with Section 00511, Escrow Agreement and Section 153.13 of the Ohio Revised Code.

ARTICLE 9 – CONTRACTOR'S REPRESENTATIONS

9.01 As part of the inducement for OWNER to enter into this Agreement CONTRACTOR makes the following representations:

- A. CONTRACTOR has familiarized himself with the nature and extent of the Contract Documents, Work, site, locality, and with all local conditions and federal, state and local laws, ordinances, rules and regulations that in any manner may affect cost, progress, performance or furnishing of the Work.
- B. CONTRACTOR has studied carefully all reports of investigations and tests of subsurface and latent physical conditions at the site or those reports that otherwise may affect cost, progress, performance or furnishing of the Work which were utilized by DESIGN PROFESSIONAL in the preparation of the Drawings and Specifications and which have been identified in the Contract Documents.
- C. CONTRACTOR has made or caused to be made examinations, investigations and tests and studies of such reports and related data in addition to those referred to in Paragraph 9.1 B as he deems necessary for the performance of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents; and no additional examinations, investigations, tests, reports, studies or similar information are or will be required by CONTRACTOR for such purposes.
- D. CONTRACTOR has correlated the results of all such observations, examinations, investigations, tests, reports and studies with the terms and conditions of the Contract Documents.
- E. CONTRACTOR has given DESIGN PROFESSIONAL written notice of all conflicts, errors or discrepancies that he has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR.

ARTICLE 10 – COORDINATION OF SPECIFICATIONS

10.01 In the event of any conflict between Contract Documents, the Project Specific Contract Documents shall govern.

10.02 The Project Specific Contract Documents include the Montgomery County Environmental Services Standard Specifications and all Supplemental Specifications, denoted by the prefix "S". DESIGN PROFESSIONAL shall provide clarifications, interpretations and decisions as stated in the General Conditions. In the event of any conflict between the requirements of the

Standard Specifications and the Supplemental Specifications, the Supplemental Specifications shall govern.

ARTICLE 11 – MISCELLANEOUS

- 11.01 **MODIFICATION.** No modification or waiver of any of the terms of this Agreement or of any other Contract Documents will be effective against a party unless set forth in writing and signed by or on behalf of a party. In the case of the OWNER, the person executing the modification or waiver must have express authority to execute the modification on behalf of the OWNER pursuant to a resolution that is duly adopted by the OWNER. Under no circumstances will forbearance, including the failure or repeated failure to insist upon compliance with the terms of the Contract Documents, constitute the waiver or modification of any such terms. The parties acknowledge that no person has authority to modify this Agreement or the other Contract Documents or to waive any of its or their terms, except as expressly provided in this paragraph.
- 11.02 **ASSIGNMENT.** The CONTRACTOR may not assign this Agreement without the written consent of the OWNER, which the OWNER may withhold in its sole discretion.
- 11.03 **LAW AND JURISDICTION.** All questions regarding the validity, intention, or meaning of this Agreement or any modifications of it relating to the rights and obligation of the parties will be construed and resolved under the laws of the State of Ohio. Any suit, which may be brought to enforce any provision of this Agreement or any remedy with respect hereto, shall be brought in the Common Pleas Court, Montgomery County, Ohio, and each party hereby expressly consents to the exclusive jurisdiction of such court.
- 11.04 **CONSTRUCTION.** The parties acknowledge that each party has reviewed this Agreement and the other Contract Documents and entered into this Agreement as a free and voluntary act. Accordingly, the normal rule of construction to the effect that any ambiguities are to be resolved against the drafting party will not be employed in the interpretation of this Agreement, the other Contract Documents, or any amendments or exhibits to it or them.
- 11.05 **APPROVALS.** Except as expressly provided herein, the approvals and determinations of the OWNER and DESIGN PROFESSIONAL will be subject to the sole discretion of the respective party and be valid and binding on the CONTRACTOR, provided only that they be made in good faith, i.e., honestly. If the CONTRACTOR challenges any such approval or determination, the CONTRACTOR has the burden of proving that it was not made in good faith by clear and convincing evidence.
- 11.06 **PARTIAL INVALIDITY.** If any term or provision of this Agreement is found to be illegal, unenforceable, or in violation of any laws, statutes, ordinances, or regulations of any public authority having jurisdiction, then, notwithstanding such term or provision, this Agreement will remain in full force and effect and such term will be deemed stricken; provided this Agreement will be interpreted, when possible, so as to reflect the intentions of the parties as indicated by any such stricken term or provision.
- 11.07 **COMPLIANCE WITH LAWS AND REGULATIONS.** The CONTRACTOR, at its expense, will comply with all applicable federal, state, and local laws, rules, and regulations applicable to the Work, including but not limited to Chapter 4115 of the Ohio Revised Code and Sections 153.59 and 153.60 of the Ohio Revised Code, which prohibit discrimination in the hiring and

treatment of employees, with respect to which the CONTRACTOR agrees to comply and to require its subcontractors to comply.

11.08 NON-DISCRIMINATION. CONTRACTOR agrees:

- A. That in the hiring of employees for the performance of Work under this Agreement or in any subcontract, neither the CONTRACTOR, subcontractor, or any person acting on behalf of either of them, shall by reason of race, creed, sex, disability as defined in Section 4112.01 of the Ohio Revised Code, or color, shall discriminate against any citizen of the state in the employment of labor or workers who are qualified and available to perform the Work to which the employment relates.
- B. That there shall be deducted from the amount payable to the CONTRACTOR by the OWNER under this Agreement a forfeiture of twenty-five dollars (\$25.00) as required by Ohio Revised Code Section 153.60 for each person who is discriminated against or intimidated in violation of this Agreement.
- C. That this Agreement may be canceled or terminated by the OWNER and all money to become due hereunder may be forfeited for a second or subsequent violation of the terms of this section of this Agreement.

11.09 PREVAILING WAGE RATES. The CONTRACTOR and its subcontractors, regardless of tier, shall strictly comply with their obligation to pay their employees working on the Project site at the applicable prevailing wage rates for the type of work, including any changes thereto, without increase in the Contract Price.

11.10 ETHICS. By signing and entering into this Agreement with the OWNER, the CONTRACTOR represents that it is familiar with all applicable ethics law requirements, including without limitation Sections 102.04 and 3517.13 of the Ohio Revised Code, and certifies that it is in compliance with such requirements. The CONTRACTOR understands that failure to comply with the ethics laws is, in itself, grounds for termination of this contract and may result in the loss of other contracts with the OWNER.

11.11 JOB MEETINGS. The CONTRACTOR or one of its representatives with authority to bind the CONTRACTOR will attend all job meetings. The OWNER anticipates that job meetings will be scheduled on a bi-weekly basis during construction or as needed. The CONTRACTOR will ensure that its subcontractors also hold regular job meetings at which safety issues and job matters are discussed as these relate to the Work being performed. Job meetings include, but are not limited to, pre-construction meetings, bi-weekly job meetings, weekly safety tool box meetings, and monthly safety meetings.

11.12 PROPERTY TAX AFFIDAVIT. The CONTRACTOR's affidavit given under Section 5719.042 Ohio Revised Code, is incorporated herein.

11.13 PARTNERING. CONTRACTOR agrees that it will participate, as part of the Contract Price, in any partnering sessions scheduled by OWNER.

11.14 ENTIRE AGREEMENT. This Agreement and the other Contract Documents constitute the entire agreement among the parties with respect to their subject matter and will supersede all prior and contemporaneous, oral or written, agreements, negotiations, communications, representations, and understandings with respect to such subject matter, and no person is

justified in relying on such agreements, negotiations, communications, representations, or understandings.

- 11.15 Terms used in this Agreement which are defined in Article 1 of the General Conditions have the meanings indicated in the General Conditions.
- 11.16 OWNER and CONTRACTOR each binds itself, its partners, successors, assigns and legal representatives to partners, successors, assigns and legal representatives in respect of all covenants, agreements and obligations contained in the Contract Documents.
- 11.17 The CONTRACTOR hereby acknowledges that this Agreement must be signed and returned to the OWNER by the CONTRACTOR within thirty (30) days of receipt of said Agreement for signature or this Agreement may be canceled and voided by the OWNER.

Eastern Regional Water Reclamation Facility Operations Building Renovation
PROJECT NO. 130012-59

AGREEMENT

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day and year first written above.

This Agreement will be effective on _____, 20_____.

ATTEST:

BOARD OF COUNTY COMMISSIONERS
OF MONTGOMERY COUNTY, OHIO

(Title)

By _____

By _____

By _____

OR

(Title)

By _____

Michael B. Colbert, Administrator
Montgomery County, Ohio

ATTEST:

CONTRACTOR (If Corporation, complete attached
affidavit)

(Title)

By _____

(Title)

(Seal if bid is by a Corporation)

APPROVED AS TO FORM:

Mathias H. Heck, Jr.
Prosecuting Attorney

By _____
Ward Barrentine
Assistant Prosecuting Attorney

CONTRACT AFFIDAVIT

(To be filled in and executed if CONTRACTOR is a Corporation)

COUNTY OF _____)
)ss:
STATE OF _____)

_____, being duly sworn, deposes and
says that he is Secretary of _____ a Corporation organized and existing
under and by virtue of the laws of the State of _____, and having its principal office at

(Street and Number) (City)

(County) (State)

Affiant further says that he is familiar with the records, minute books and by-laws
of _____ .
(Name of Corporation)

Affiant further says that _____
(Officer's Name)

is _____, of the Corporation, is duly
authorized to sign the Contract for _____
_____ for said

Corporation by virtue of _____
(State whether a provision of by-laws or a

Resolution of the Board of Directors and if by Resolution, give date of adoption.)

Signed: _____
(Affiant)

Typed or printed name: _____

Title: _____

Sworn to and subscribed in my presence this _____ day of
_____, 20____.

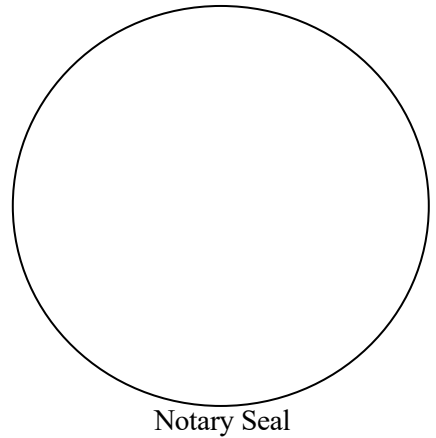
(written signature) _____

(typed or printed name) _____

Notary Public, State of Ohio

My commission expires

(month, day, year)



Notary Seal

END OF SECTION

SECTION 00511

ESCROW AGREEMENT

This Escrow Agreement (herein "Agreement") entered into on the _____ day of _____, 20____, by and among Montgomery County (herein "OWNER"), a municipality created and existing under the laws of the State of Ohio; _____ (herein "CONTRACTOR"), a Corporation organized and existing under the laws of the State of Ohio/a Partnership/an Individual; and (herein "Escrow Agent"), an Ohio Banking Association organized and existing under the laws of the State of Ohio, all being duly authorized to execute and deliver this Agreement.

WITNESSETH:

WHEREAS, OWNER and CONTRACTOR have heretofore entered into that certain contract (or contracts) described in Schedule "A" hereto with respect to the project (or projects) therein described (such contract or contracts, as hereafter amended or supplemented, being herein referred to as "Contract"); and

WHEREAS, Amended Senate Bill 251, effective December 2, 1975, (a) requires creation of an escrow account into which shall be deposited Contract payments retained by OWNER in accordance with Sections 153.12 and 153.13 of the Ohio Revised Code (herein "Retained Amounts"), and (b) imposes certain other requirements with respect to the time of payment of Retained Amounts, the terms of this Agreement, the settlement of disputes, and other matters; and

WHEREAS, OWNER, CONTRACTOR and Escrow Agent intend this Agreement to comply in all respects with Amended Senate Bill 251, and hereby agree that this Agreement shall be so construed as to further the purpose and intent of said law;

NOW, THEREFORE, OWNER, CONTRACTOR AND ESCROW AGENT, INTENDING TO BE LEGALLY BOUND, do hereby agree as follows:

Section 1. Deposit of Retained Amounts. Escrow Agent hereby acknowledges deposit with it of the cash and/or securities described in Schedule "B" hereto (herein "Escrowed Fund") any securities included in such deposit being hereby expressly approved by Escrow Agent as selected by it in accordance with Section 153.63 of the Ohio Revised Code. OWNER and CONTRACTOR hereby acknowledge and affirm that such deposit (any securities included therein being valued at market) represents the full sum of Retained Amounts lawfully retained by Owner to date, pursuant to Section 153.12 of the Ohio Revised Code, with respect to the Contract.

Section 2. Investment or Reinvestment of Escrowed Funds. Until payment of the Escrowed funds, including interest thereon, to CONTRACTOR in accordance with Section 3, hereof, the Escrow Agent shall invest and reinvest the Escrowed Funds, and, to the extent commercially feasible in the judgment of the Escrow Agent, the interest earned thereon, in the following described savings accounts or obligations:

- (a) Savings accounts maintained with the Escrow Agent, or with any bank or domestic building and loan association which would be eligible to become a public depository under Section 135.03 of the Ohio Revised Code.

- (b) Bonds or other obligations of the United States of America or agencies thereof.
- (c) "Master Notes" maintained in or by the Trust Department.

Section 3. Disbursement of Escrowed Funds. The Escrowed Funds, including interest earned thereon, after expiration of such reasonable time (not exceeding thirty (30) days) as shall be required to permit orderly liquidation of any investments thereof made in accordance with Section 2 hereof, shall be paid by Escrow Agent to CONTRACTOR in the event of, and in accordance with, any of the following:

- (a) Receipt by Escrow Agent of notice or concurrent notices of similar purport from OWNER and CONTRACTOR that the Escrowed Funds are to be paid to CONTRACTOR.
- (b) Receipt by Escrow Agent of (i) a true copy of an arbitration order; (ii) a certified judgment of the Court of Claims created by Section 2743.03 of the Ohio Revised Code; provided that in the case of (i), the Escrow Agent shall also receive the written waivers of the OWNER and CONTRACTOR of their respective rights under Section 2711.09 of the Ohio Revised Code, unless the statutory period for exercise of such rights shall have elapsed, and in the case of (ii), the Escrow Agent shall also receive a waiver or waivers of the OWNER's or CONTRACTOR's right or rights of appeal in form and substance satisfactory to Escrow Agent, unless the period for appeal shall have elapsed; or (iii) a certified final judgment from a court of competent jurisdiction.

Section 4. Compensation of Escrow Agent. Escrow Agent shall receive a fee for its services in an amount equal to the standard fees applicable and in effect at the time of this Agreement and as revised from time to time at the discretion of the Escrow Agent. In addition to such fee, Escrow Agent shall be entitled to reimburse itself from the same source or from the Escrowed Funds for reasonable attorneys' fees and costs incurred by it under this Agreement, provided that if such fees or costs are incurred subsequent to payment to CONTRACTOR of the Escrowed Funds and interest thereon and otherwise than by reason of negligence or bad faith on the part of Escrow Agent, such fees and costs shall be paid by CONTRACTOR to Escrow Agent on demand. OWNER shall not become liable to CONTRACTOR for any fees retained by Escrow Agent out of the Escrowed Funds.

Section 5. Escrow Agent's Acceptance and Responsibilities; Indemnification by CONTRACTOR; Successor Escrow Agent. Escrow Agent accepts the duties imposed upon it by this Agreement, and agrees to perform said duties with ordinary prudence, but only upon and subject to the following terms and conditions:

- (a) Escrow Agent may rely, and shall be protected in acting or refraining from acting, upon any instrument furnished to it hereunder and believed by it to be genuine and believed by it to have been signed or presented by appropriate party or parties (including without limitation, with respect to any corporation, any instrument purporting to have been signed on its behalf by its president or any of its vice presidents or its treasurer) Escrow Agent shall not be liable for any action taken (or any refraining from action) by it in good faith and believed by it to be authorized or within the rights or powers conferred upon it in this Agreement. Escrow Agent may consult with counsel of its choice and shall be fully protected in acting or refraining to act in good faith and in accordance with the opinion of such counsel.
- (b) CONTRACTOR hereby agrees to indemnify and hold Escrow Agent harmless against any loss, liability or expense incurred, without negligence or bad faith on its part, in connection with any claim arising out of or in connection with its entering into this Agreement and carrying out its duties hereunder, including the cost of defending itself against such claim.

(c) Escrow Agent's accounts relative to the Escrowed Funds and interest thereon shall be subject to audit by the Auditor of the State of Ohio and shall be made available for such purpose during regular business hours.

(d) By thirty (30) days' notice to OWNER and CONTRACTOR, Escrow Agent may resign as such hereunder, and in such event shall, upon demand, deliver the Escrowed Funds and interest earned thereon to a successor escrow agent designated jointly by OWNER and CONTRACTOR, or in default of such designation within thirty (30) days after such notice is received by OWNER, shall deliver the Escrowed Funds and interest earned thereon to OWNER. In the event of CONTRACTOR's failure to concur in the reasonable selection by OWNER or a successor escrow agent within such period, with the result that the Escrowed Funds and interest earned thereon are so delivered to OWNER, OWNER shall not be liable to CONTRACTOR for any additional interest on the Escrowed Funds or on the interest previously earned thereon until and unless CONTRACTOR shall have concurred as aforesaid and a new escrow agreement shall have been entered into among OWNER, CONTRACTOR and a successor escrow agent, CONTRACTOR hereby waiving to such extent its rights under Section 153.63 of the Ohio Revised Code.

Section 6. Notices. It shall be sufficient service or giving of any notice, request, complaint, demand or other paper if the same shall be duly deposited in the United States mail, registered or certified mail, postage prepaid, addressed as follows:

(a) To OWNER:

Montgomery County
Board of County Commissioners
451 W. Third Street
Dayton, Ohio 45422
Attention: Clerk of Commission

Duplicate To:
Montgomery County
Environmental Services
1850 Spaulding Road
Dayton, Ohio 45432
Attn: Shawn D. Bailey

(b) To CONTRACTOR:

(c) To Escrow Agent:

Duplicate copies of each notice, certificate or other communication given hereunder by OWNER, CONTRACTOR or Escrow Agent to one of the others shall also be given to the other. The OWNER, CONTRACTOR or Escrow Agent may, by notice given hereunder, designate any further or different addresses to which subsequent notices, certificates or other communications shall be sent, but no notice directed to any one such entity shall thereby be required to be sent to more than two (2) addresses.

Section 7. Mechanic's Liens; Additional Deposits with Escrow Agent. In the event that one (1) or more sworn and itemized statements are filed with OWNER pursuant to Section 1311.26 of the Ohio Revised Code, with the result that Section 1311.28 of the Ohio Revised Code applies, but the Escrowed Funds shall have been fully disbursed by Escrow Agent, neither the State of Ohio, OWNER nor Escrow Agent shall have any liability with respect thereto otherwise than pursuant to mechanic's lien laws of general application.

Should any such filing be made by CONTRACTOR, OWNER reserves the right to deposit funds detained by reason of such filing with Escrow Agent hereunder, which funds shall (a) be invested and reinvested in the same manner as provided for Escrowed Funds under Section 2 hereof, and (b) be released at such times, in such amounts, and to such persons as may be ordered by a court of competent jurisdiction or by agreement of CONTRACTOR and OWNER.

Section 8. Miscellaneous. The CONTRACTOR hereby acknowledges that this Agreement must be signed and returned to Montgomery County Environmental Services by the CONTRACTOR within thirty (30) days of receipt of said Agreement for signature or this Agreement may be canceled and voided by Montgomery County.

Eastern Regional Water Reclamation Facility Operations Building Renovation
Project No. 130012-59
Escrow Agreement

EXECUTED, at Dayton, Ohio on the __ day of _____, 20__.

ATTEST:

BOARD OF COUNTY COMMISSIONERS
OF MONTGOMERY COUNTY, OHIO

(Title)

By _____

By _____

By _____

OR

(Title)

By _____

Michael B. Colbert
Administrator,
Montgomery County, Ohio

(Contractor)

(Title)

By _____

(Escrow Agent)

(Title)

By _____

APPROVED AS TO FORM BY

MATHIAS H. HECK, JR., Prosecuting Attorney

By: _____

Assistant Prosecuting Attorney

SCHEDULE "A"

Description of contract or contracts:

Eastern Regional Water Reclamation Facility Operations Building Renovation

Project No. 130012-59

SCHEDULE "B"

(SAMPLE:)

Description of Escrowed Funds:

None -

Date

Total Escrowed Funds to Equal 4% of Total Contract Price

Which is the Allowable Retainage Under the Ohio Revised

Code to be deposited and receipted for at a later date.

END OF SECTION

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SECTION 00512

PERFORMANCE/PAYMENT BOND
(Sec. 153.57 Ohio Revised Code)

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned _____

_____ as Principal, and

_____ as Surety, are hereby held and firmly bound unto Montgomery County Board of County Commissioners hereinafter called the OWNER, in the penal sum of _____ Dollars (\$ _____)

to undertake the project known as _____, for the payment of which well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that whereas the above named Principal has entered into a contract with the OWNER, dated the

_____ day of _____, 20____, for the above referred to project, which said contract is made a part of this bond the same as though set forth herein.

IF THE SAID Principal shall well and faithfully perform each and every condition of such contract; and indemnify the Montgomery County Board of County Commissioners against all damage suffered by failure to perform such contract according to the provisions thereof and in accordance with the plans, details, specifications, and bills of material therefor; and shall pay all lawful claims of subcontractors, materialmen, and laborers, for labor performed and materials furnished in the carrying forward, performing, or completing of said contract, we agreeing and assenting that this undertaking shall be for the benefit of any materialmen or laborer having a just claim, as well as for the Obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

THE SAID Surety hereby stipulates and agrees that no modifications, omissions, or additions, in or to the terms of the said contract or in or to the plans and specifications therefor shall in any wise affect the obligations of said Surety on this bond, and it does hereby waive notice of any such modifications, omissions or additions to the terms of the contract or to the work or to the specifications.

SIGNED AND SEALED this ____ day of _____, A.D. 20 ____.

PRINCIPAL: _____

BY: _____
(Signature)

(Typed or Printed Name)

TITLE: _____

SURETY: _____

BY: _____
(Attorney/Attorney-in-Fact Signature*)

(Typed or Printed Attorney/Attorney-in-Fact Name*)

* Attach certified and effective dated copy of power of attorney showing authority of attorney-in-fact to execute in behalf of corporation.

Sec. 9.32 of the Ohio Revised Code requires awarding authorities to simultaneously with notice of award to contractor, to give written notice to Surety and Agent. Show name and mailing addresses of both Agent and Surety.

SURETY COMPANY ADDRESS:

SURETY AGENT'S NAME AND ADDRESS:

END OF SECTION

WAIVER OF ESCROW ACCOUNT

The CONTRACTOR has the right to an escrow account pursuant to Ohio Revised Code § 153.63. Ohio Revised Code § 153.63 requires that funds retained pursuant to Ohio Revised Code §§ 153.12, 153.13 and 153.14 (the retainage) be promptly deposited into an escrow account until such time as the CONTRACTOR'S contractual requirements are complete.

The CONTRACTOR willfully and voluntarily desires to waive this right to escrow by execution of this document below.

The CONTRACTOR fully understands its right under Ohio law to an escrow account.

The CONTRACTOR understands that all funds held in retainage will be held by the OWNER until the completion of all contractual requirements and acceptance of the project by OWNER.

I, _____, of _____ have read the above and fully understand my
Name Company

rights under Ohio Revised Code § 153.63. I knowingly, voluntarily, and freely waive my right to have funds deposited in an escrow account for _____, _____ .
Project Project No.

Signed: _____
(Affiant)

Typed or printed name: _____

Title: _____

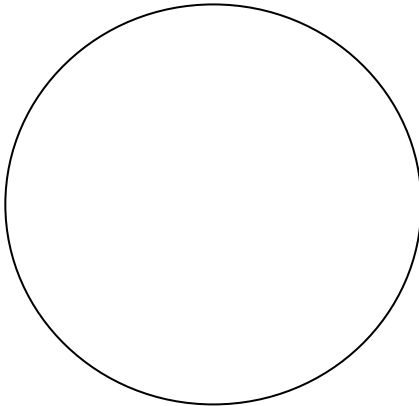
Sworn to and subscribed in my presence this _____ day of _____, 20__.

(written signature) _____

(typed or printed name) _____

Notary Public, State of Ohio

My Commission Expires: _____
(month, day, year)



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SECTION 00520

NOTICE TO PROCEED

To: _____ Date: _____

Project:

MONTGOMERY COUNTY, OHIO
Eastern Regional Water Reclamation Facility Operations Building Renovation
PROJECT NO. 130012-59

You are hereby notified to commence Work in accordance with the Agreement

dated _____, 20____, authorized by Resolution

No. _____ dated _____, on or before _____

_____, 20____ hereinafter referred to as the effective date of the Notice to Proceed. You are to complete the work in accordance with the milestone schedule in the Owner-Contractor Agreement (the "Agreement"), which is repeated below for reference only. The milestone work activity durations are as stated in the Agreement and are calendar days. The milestone dates are established based on the number of calendar days after the effective date of the Notice to Proceed. Liquidated damages in the amount set forth below will accrue per calendar day for each calendar day the work remains incomplete after its associated milestone date, as more fully set forth in the Agreement. Liquidated Damages will be imposed unless the Contract Times are otherwise adjusted for by change order to the Agreement. Note that special damages, if applicable, will also be imposed in accordance with the Agreement.

MILESTONE	MILESTONE WORK ACTIVITY DURATION	MILESTONE DATE	LIQUIDATED DAMAGES
Milestone No. 1	180 Days	Date	\$0
Milestone No. 2	365 Days	Date	\$0
Milestone No. 3	365 Days	Date	\$600
Milestone No. 4	395 Days	Date	\$0
Milestone No. 5	455 Days	Date	\$0

Please return a copy of this Notice to Proceed to the undersigned, indicating your receipt of this document in the space provided below.

By _____

Title _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO
PROCEED is hereby acknowledged by

_____ ,

this the _____ day

of _____, 20____

By _____

Title _____

END OF SECTION

SECTION 00530

NOTICE OF COMMENCEMENT FOR
PUBLIC IMPROVEMENT UNDER
SECTION 1311.252 OF THE OHIO REVISED CODE

The undersigned, _____, of _____,
_____, first being sworn gives the following information with respect to the
indicated public improvement.

1. The name of the public improvement is Eastern Regional Water Reclamation Facility Operations Building Renovation.
2. The public improvement is located in Montgomery County, Ohio.
3. The project number for the public improvement is 130012-59.
4. The name and address of this public authority is as follows:

Montgomery County Board of Commissioners
Attn: Shawn D. Bailey
1850 Spaulding Road
Dayton, Ohio 45432

5. The date of the Agreement with _____ is _____.
6. The name and address of all principal contractors working on the public improvement, the trade of each principal contractor, and the name and address of the surety for each principal contractor are as follows:

A. _____

Surety: _____

B. _____

Surety: _____

7. The name and address of the representative of the public authority for the purposes of serving the lien affidavit are as follows:

Clerk, Montgomery County Board of Commissioners
451 W. Third St.
Dayton, Ohio 45422

County of Montgomery
State of Ohio

Signed: _____
(Affiant)

Typed or printed name: _____

Title: _____

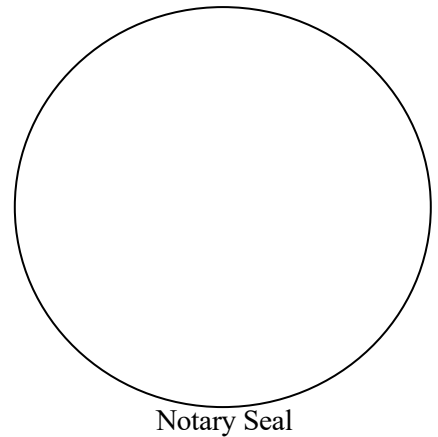
Sworn to and subscribed in my presence this _____ day of
_____, 20____.

(written signature) _____

(typed or printed name) _____

Notary Public, State of Ohio
My commission expires

(month, day, year)



Note. If the public improvement is a fast track construction project which is bid in stages, then the public authority should update the notice of commencement to reflect the additional principal contractors and their sureties as additional contracts are awarded.

END OF SECTION

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SECTION 00560

DELINQUENT PERSONAL PROPERTY TAX AFFIDAVIT
(Must be Executed by the Successful Bidder)

AFFIDAVIT

STATE OF OHIO)
) SS
COUNTY OF _____)

_____, being first duly sworn, deposes and says
that he/she is _____, a duly authorized representative
(Title)

of _____, the Successful Bidder on
(Contractor)

the attached Contract with the Board of County Commissioners, Montgomery County,

Ohio, for _____, and for the purpose of
(describe or identify contract)

complying with Section 5719.042 of the Ohio Revised Code, states that at the

time the Bid for said Contract was submitted, said Bidder _____
(was)(was not)

charged with delinquent personal property taxes on the General Tax list of

personal property in Montgomery County.

The amount of such due and unpaid delinquent taxes, penalties and interest
thereon is as follows:

<u>Taxes</u>	<u>Penalties & Interest</u>	<u>Total</u>
\$ _____	\$ _____	\$ _____
\$ _____	\$ _____	\$ _____
\$ _____	\$ _____	\$ _____

Signed: _____
(Affiant)

Typed or printed name: _____

Title: _____

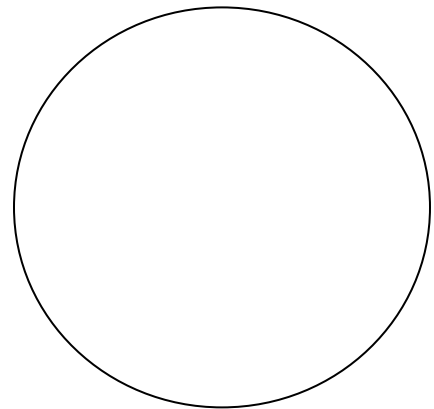
Sworn to and subscribed in my presence this _____ day of
_____, 20____.

(written signature) _____

(typed or printed name) _____

Notary Public, State of Ohio
My commission expires

(month, day, year)



Notary Seal

END OF SECTION

SECTION 00561

NON-COLLUSION AFFIDAVIT

The following non-collusion affidavit will be completed only by the Successful Bidder to whom the OWNER proposed to award the Contract.

The OWNER reserves the right to require the Successful Bidder to submit such an affidavit, dated and executed after the opening of the Bids, as a condition precedent to its award of the Contract.

AFFIDAVIT OF PRINCIPAL CONTRACTOR

STATE OF _____ :
:SS
COUNTY OF _____ :

_____ being first duly sworn, deposes and
says that he is _____
(Sole Owner/Partner/President/Secretary/Other Title)

of _____ who on _____,
(Name of Bidder) (Date Bid Submitted)

20____, submitted to _____

_____ a Bid as set forth in the attached copy; that all statements of fact in such Bid are true; that such Bid was not made in the interest of or on behalf of any undisclosed person, partnership, company, association, organization, or corporation; that such Bid is genuine and not collusive or sham; that said Bidder has not directly or indirectly, by agreement, communication of conference with anyone attempting to induce action prejudicial to the interests of the public body which is to award the contract, or of any other Bidder or anyone else interested in the proposed contract; and further, that prior to the public opening and reading of Bids, said Bidder,

- (a) did not directly or indirectly, induce or solicit anyone else to submit a false or sham Bid;
- (b) did not directly or indirectly, collude, conspire, connive or agree with anyone else that said bidder or anyone else would submit a false or sham bid, or that anyone should refrain from bidding or withdraw his bid;
- (c) did not, in any manner, directly or indirectly, seek by agreement, communication or conference with anyone to raise or fix the Bid price of said Bidder or of anyone else, or to raise or fix any overhead, profit or cost element of his Bid price, or that of anyone else;
- (d) did not, directly or indirectly, submit his Bid price or any breakdown thereof, or the contents thereof, or divulge information or data relative thereto, to any corporation, partnership, company, association, organization, Bid depository, or to any member or agent thereof, or to any individual or group of individuals, except to the awarding authority or to any person or persons who have a partnership or other financial interest with said Bidder in his business; and

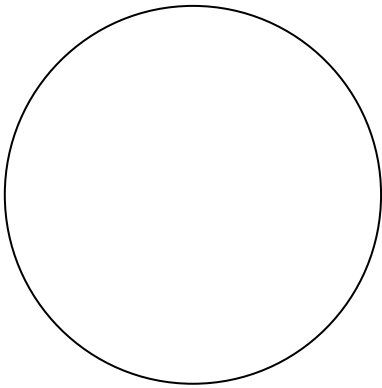
- (e) did not include in his Bid price any fees, dues, charges, or assessments because required to do so by reason of his membership in or affiliation with any association, organization, corporation, partnership, company, individual or group of individuals, or because of any agreement or understanding with anyone that he would do so.

Signed: _____
(Affiant)

Typed or printed name: _____

Title: _____

Sworn to and subscribed in my presence this _____ day of _____, 20____.



Notary Seal

(written signature) _____

(typed or printed name) _____

Notary Public, State of Ohio
My commission expires

(month, day, year)

END OF SECTION

SECTION 00562

NON-COLLUSION AFFIDAVIT

The OWNER reserves the right to require, as a condition precedent to its approval of proposed subcontractors, that the principal contractor shall submit to the OWNER the name of each of the proposed subcontractors and upon notice of approval of said subcontractors by the OWNER, the principal contractor shall furnish satisfactory non-collusion affidavits in the following form executed by each accepted subcontractor.

AFFIDAVIT OF SUBCONTRACTOR

STATE OF _____ :
SS:
COUNTY OF _____ :

_____ being first duly sworn, deposes
and says that he is _____
(Sole Owner/Partner/President/Secretary/Other Title)
of _____ who on _____,
(Name of Proposed Subcontractor) (Date Bid Submitted)
20____, submitted to _____
(Name of Principal Contractor)

a Bid as set forth in the attached copy, for a subcontract; that all statements of fact contained in such Bid are true; that such Bid was not made in the interest of or on behalf of any undisclosed person, partnership, company, association, organization, or corporation; that such Bid is genuine and not collusive or sham; and further, that prior to the execution of this affidavit, said Bidder,

- (a) has not, directly or indirectly, induced or solicited anyone else to submit a false or sham Bid to said principal contractor or to anyone else;
- (b) has not, directly or indirectly, colluded, conspired, connived or agreed with anyone else that said Bidder or anyone else would submit a false or sham Bid to said principal contractor or to anyone else, or that anyone should refrain from Bidding or withdraw his Bid;
- (c) has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to raise or fix the Bid price of said Bidder or of anyone else, or to raise or fix any overhead, profit or cost element of his Bid price, or that of anyone else;
- (d) did not, directly or indirectly, submit his Bid price or any breakdown thereof, or the contents thereof, or divulge information or data relative thereto, to any corporation, partnership, company, association, organization, Bid depository, or to any member or agent

thereof, or to any individual or group of individuals, except to the awarding authority or to any person or persons who have a partnership of other financial interest with said Bidder in his business; and

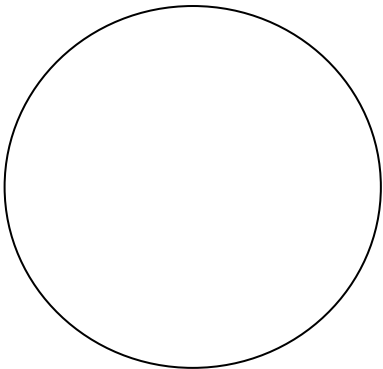
- (e) did not include in his Bid price any fees, dues, charges, or assessments because required to do so by reason of his membership in or affiliation with any association, organization, corporation, partnership, company, individual or group of individuals, or because of any agreement or understanding with anyone that he would do so.

Signed: _____
(Affiant)

Typed or printed name: _____

Title: _____

Sworn to and subscribed in my presence this _____ day of _____, 20____.



Notary Seal

(written signature) _____

(typed or printed name) _____

Notary Public, State of Ohio
My commission expires

(month, day, year)

END OF SECTION

STATE OF OHIO
DEPARTMENT OF TAXATION
CONSTRUCTION CONTRACT EXEMPTION CERTIFICATE

Identification of Contract:

Contractee's (Owner's) Name: _____

Exact Location of Job/Project: _____

Name of Job/Project as it appears
on Contract Documentation: _____

The undersigned hereby certifies that the tangible personal property purchased under this exemption certificate was purchased for incorporation into:

- ☐ real property under a construction contract with the United States government, its agencies, the State of Ohio, or an Ohio political subdivision.
- ☐ real property which is owned or will be accepted for ownership at the time of completion, by the United States government, its agencies, the State of Ohio, or an Ohio political subdivision.
- ☐ a house of public worship or religious education.
- ☐ a building used exclusively for charitable purposes by a nonprofit organization operated exclusively for charitable purposes as defined in section 5739.02(B)(12) of the Revised Code.
- ☐ the original construction of a sports facility under section 307.696 of the Revised Code.
- ☐ a hospital facility entitled to exemption under section 140.08 of the Revised Code.

The original of this certificate must be signed by the owner/contractee and/or government official and must be retained by the prime contractor. Copies must be maintained by the owner/contractee and all subcontractors. When copies are issued to suppliers when purchasing materials, each copy must be signed by the contractor or subcontractor making the purchase.

Prime Contractor

Owner/Contractee

Name _____

Name _____

Signed by _____

Signed by _____

Title _____

Title _____

Address _____

Address _____

City, State, Zip _____

City, State, Zip _____

Date _____

Date _____

Subcontractor

Political Subdivision

Name _____

Name _____

Signed by _____

Signed by _____

Title _____

Title _____

Address _____

Address _____

City, State, Zip _____

City, State, Zip _____

Date _____

Date _____

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SECTION 00670

PREVAILING WAGES
AFFIDAVIT OF CONTRACTOR

AFFIDAVIT

(To be completed by all Contractors and Subcontractors)

I, _____, _____
(Name of person signing affidavit) (Title)

of the _____, do hereby certify that the
wages paid to all employees for the full number of hours worked in connection with
the Contract for the Improvement, Repair and Construction of:

(Project & Location)

during the following period from _____ to _____
is in accordance with the prevailing wage prescribed by the contract document.

I further certify that no rebates or deductions for any wages due any person have
been directly or indirectly made other than those provided by law.

(Signature of Officer or Agent)

Typed or printed name: _____

Title: _____

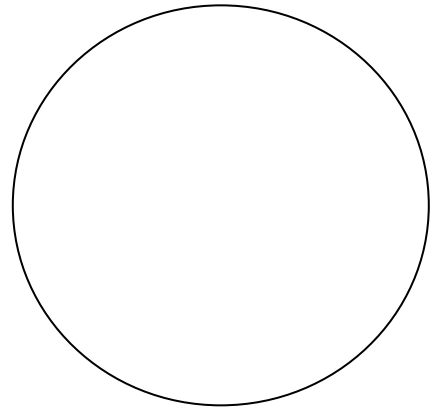
Sworn to and subscribed in my presence this _____ day of
_____, 20____.

(written signature) _____

(typed or printed name) _____

Notary Public, State of Ohio
My commission expires

(month, day, year)



Notary Seal

The above affidavit must be executed and sworn to by the officer or agent of the CONTRACTOR who supervises the payment of employees, before the OWNER will release the surety and/or make a final payment due under the terms of the contract.

END OF SECTION

SECTION 00679

CONTRACTOR'S PAYMENT APPLICATION CHECKLIST

THE CONTRACTOR MUST COMPLETE THIS CHECKLIST AND SUBMIT IT TO THE OWNER WITH ITS PAYMENT APPLICATION AND ALL REQUIRED DOCUMENTATION.

1. Contractor's Name: _____
2. Name, title, and telephone and e-mail address of Contractor's representative to contact regarding the Payment Application and required documentation:
Name: _____ Title: _____
Office Telephone No.: (____) _____ E-mail address: _____
3. Payment Application Number and Date:
No. _____ Date: _____, 20____
4. The following is a list of required documentation that must accompany its Payment Application. The Contractor certifies that it has submitted the documentation listed below with its Payment Application. If the Contractor cannot do so, the Contractor should explain why in Paragraph 5. Such explanations shall not excuse the Contractor from the requirements for submitting this documentation.
 - _____ .1 One (1) copy of a properly completed and executed Application for Payment with a properly completed and executed Schedule of Values attached to each;
 - _____ .2 Properly Completed Contractor's Affidavit with List of Subcontractors and Suppliers and Any Amounts Withheld (00680);
 - _____ .3 Contractor's Waiver and Release Affidavit (beginning with the second Application for Payment) (00681);
 - _____ .4 For each of its Subcontractors and Suppliers, a Subcontractors and Suppliers Waiver and Release Affidavit (beginning with the second Application for Payment) (00682);
 - _____ .5 Schedule of all materials and equipment stored on-site;
 - _____ .6 For materials and equipment stored off-site:
 - _____ A list of the materials and equipment consigned and stored off-site in connection with the Project (which shall be clearly identified), giving the place of storage, together with copies of invoices and reasons why the materials and equipment cannot be delivered to the site;
 - _____ Certification that all items have been tagged for delivery to the Project and that they will not be used for any other purpose;
 - _____ A letter from the Contractor's surety bonding company indicating agreement to the arrangements and that payment to the Contractor shall not relieve either party of its responsibility to complete the facility;

- _____ Evidence of adequate insurance covering the material and equipment in storage, which shall name the Owner as additional insured;
 - _____ Evidence that the Owner or duly authorized representative has visited the Contractor's place of storage and found that all the materials and equipment set forth in the payment request and represented to be stored off-site are stored at the place of storage (any costs incurred by the Owner to inspect material and equipment in off-site storage shall be paid by the Contractor); and
 - _____ Itemization of the materials and equipment and their cost, which were approved on previous Pay Applications and which remain in off-site storage.
- _____ .7 Other documentation or information required by the Contract Documents or by the Design Professional or Owner.

5. Reason why required documentation is not submitted:

NOTE: The failure to submit required documentation, regardless of the reason, may result in non-payment, partial payment, and/or late payment.

Signature

Printed Name

Date

OWNER'S REVIEW

- _____ Checklist and documentation complete.
- _____ Checklist and documentation incomplete.

Signature

Printed Name

Date

SECTION 00680

**CONTRACTOR'S AFFIDAVIT AND CERTIFICATION WITH LIST OF SUBCONTRACTORS
AND SUPPLIERS WITH ANY AMOUNTS WITHHELD**

PROJECT: _____

CONTRACTOR: _____

In Support of PAYMENT APPLICATION No.: _____

For the Period Through: _____

STATE OF _____ :
: SS,
COUNTY OF _____ :

The undersigned after first being sworn swears that a) all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment; b) set forth below is a complete list of its Subcontractors and Suppliers; and c) set forth below is a complete description of all amounts withheld from any Subcontractor or Supplier and the reason why. Attach additional sheets if necessary.

Typed or Printed Name of Subcontractor or Supplier	Address of Subcontractor or Supplier	Telephone Number of Subcontractor or Supplier

WITHHOLDINGS FROM SUBCONTRACTORS AND/OR SUPPLIERS:

Typed or Printed Name of Subcontractor or Supplier	Amount Withheld	Reason for Withholding

Moreover, Contractor certifies that, except for as set forth immediately above, Contractor has paid all of its subcontractors and suppliers who were due to be paid with the proceeds of the prior Application for Payment and Contractor acknowledges that Owner is relying upon such certification when paying Contractor the amount asked for in the payment application that this Affidavit and Certification supports.

Signed: _____
(Affiant)

Typed or printed name: _____

Title: _____

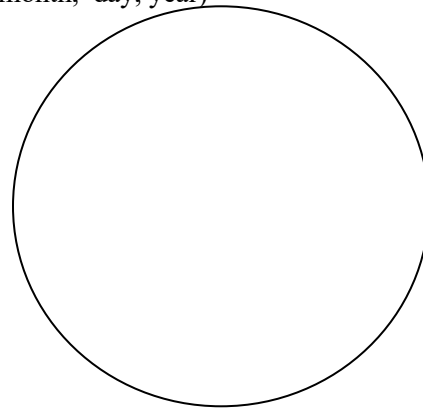
Sworn to and subscribed in my presence this _____ day of
_____, 20____.

(written signature) _____

(typed or printed name) _____

Notary Public, State of Ohio
My commission expires

(month, day, year)



Notary Seal

END OF SECTION

SECTION 00681

**CONTRACTOR'S WAIVER and RELEASE AFFIDAVIT
("AFFIDAVIT")**

(To be completed by Prime Contractors)

STATE OF _____)
) ss
COUNTY OF _____)

PROJECT: _____

The undersigned hereby acknowledges receipt of payment for all Work on the Project through the date of the prior Application for Payment by the Board of Commissioners for Montgomery County, Ohio (the "OWNER") with which it has a contract for the Project.

In return for said payment, and/or pursuant to certain contractual obligations of the undersigned, the undersigned hereby waives and releases any rights it has or may have through the date of the last Application for Payment to any and all types of claims relating to the Project, including without limitation claims of payment, Mechanic's Lien, stop notice, equitable lien, labor and material bond, breach of contract or unjust enrichment, or any other claim against the OWNER, for any labor, materials, or equipment the undersigned may have delivered or provided to the Project, except for any Claims the undersigned has made by properly and timely submitting a Statement of Claim. The undersigned further certifies that this Affidavit covers claims by all Contractors, Subcontractors, and suppliers who may have provided any labor, material, or equipment to the Project through the undersigned or at the undersigned's request. The undersigned acknowledges that all such Contractors, Subcontractors, sub-subcontractors and suppliers have signed an affidavit in the form of this Affidavit releasing any and all claims against the OWNER, except for any Claims the undersigned has made by properly and timely submitting a written Statement of Claim. The undersigned hereby represents and warrants that it has paid any and all welfare, pension, vacation or other contributions required to be paid on account of the employment by the undersigned of any laborers on the Project.

This Affidavit is for the benefit of, and may be relied upon by the OWNER. The undersigned hereby agrees to indemnify, defend and hold harmless each of the foregoing, the Project, work of improvement, and real property from any and all claims, or liens arising out of work covered by this release.

Authorized Signature: _____
(Affiant)

Typed or printed name: _____

Company/Contractor Name: _____

Title: _____

Date: _____

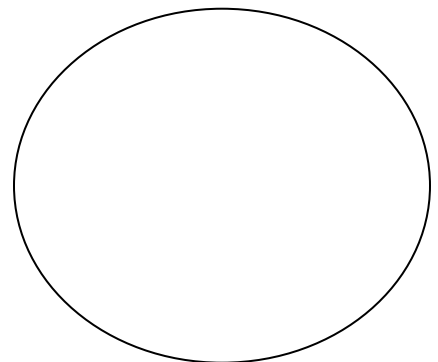
Sworn to and subscribed in my presence this _____ day of
_____, 20____.

(written signature) _____

(typed or printed name) _____

Notary Public, State of Ohio
My commission expires

(month, day, year)



Notary Seal

END OF SECTION

SECTION 00682

SUBCONTRACTORS and SUPPLIERS
WAIVER and RELEASE AFFIDAVIT ("AFFIDAVIT")

STATE OF _____)
) ss
COUNTY OF _____)

PROJECT: _____)

The undersigned hereby acknowledges receipt of payment for all Work on the Project through the date of the prior Application for Payment by the Contractor ("CONTRACTOR") with which it has a contract.

In return for said payment, and/or pursuant to certain contractual obligations of the undersigned, the undersigned hereby waives and releases any rights it has or may have through the date of the Contractor's last Application for Payment and to any and all types of claims relating to the Project, including without limitation claims of payment, Mechanic's Lien, stop notice, equitable lien, labor and material bond, breach of contract or unjust enrichment, or any other claim against the CONTRACTOR, the Contractor's surety, and/or the Board of Commissioners for Montgomery County, Ohio (the "OWNER"), for any labor, materials, or equipment the undersigned may have delivered or provided to the Project, except for any Claims the undersigned has made by properly and timely submitting a Statement of Claim form, a copy of which has been delivered to the OWNER. The undersigned further certifies that this Affidavit covers claims by all contractors, subcontractors and suppliers through the date of the CONTRACTOR's last Application for Payment who may have provided any labor, material, or equipment to the Project through the undersigned or at the undersigned's request. The undersigned acknowledges that all such contractors, subcontractors, sub-subcontractors and suppliers have signed an affidavit in the form of this Affidavit releasing any and all claims against the CONTRACTOR, the Contractor's surety, and/or the OWNER, except for any Claims made by properly and timely submitting a Statement of Claim form a copy of which has been delivered to the OWNER. The undersigned hereby represents and warrants that it has paid any and all welfare, pension, vacation or other contributions required to be paid on account of the employment by the undersigned of any laborers on the Project.

The undersigned agrees that upon receipt of the payment from the CONTRACTOR with respect to the CONTRACTOR's current Application for Payment, it shall, if applicable, immediately execute and cause to be filed or recorded a legally effective Satisfaction of Lien, Release of Lien, or any other legal instrument necessary to cause prejudicial dismissal and release of any lien, encumbrance, lawsuit, or other claim against the CONTRACTOR, the Contractor's surety and the OWNER, the property where the Project is located, and/or any surety bond posted by the CONTRACTOR or the OWNER to the extent of the foresaid payment. Upon request of the CONTRACTOR, the undersigned shall provide proof of having complied with this obligation.

This Affidavit is for the benefit of, and may be relied upon by, the CONTRACTOR, the Contractor's surety and the OWNER. The undersigned hereby agrees to indemnify, defend and hold harmless each of the foregoing, the Project, its Work, and real property from any and all claims, or liens arising out of work covered by this release and from any liability, cost, or expense incurred as a result of any breach of this Affidavit by the undersigned.

Authorized Signature: _____
(Affiant)

Typed or printed name: _____

Company/Contractor Name: _____

Title: _____

Date: _____

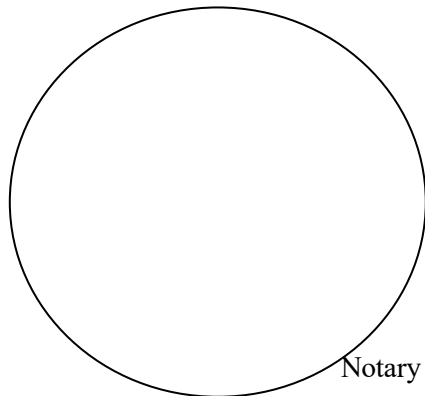
Sworn to and subscribed in my presence this _____ day of
_____, 20____.

(written signature) _____

(typed or printed name) _____

Notary Public, State of Ohio
My commission expires

(month, day, year)



Notary Seal

END OF SECTION

MONTGOMERY COUNTY ENVIRONMENTAL SERVICES
Eastern Regional Water Reclamation Facility Operations Building Renovation
PROJECT NO. 130012-59

FIELD ORDER NO. **

To: Contractor Name
Contractor Address
Contractor Address

Attn: Contractor Contact

Title: Short Description of Field Order

Description:

1. Provide Detailed Description. Reference appropriate specification sections and drawing numbers. Attach sketches as appropriate.

Reason:

1. Brief reason or justification for field order.

c:

Issued By: _____

Title

Issue Date: _____

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CHANGE ORDER FORM

Change Order No. _____

Owner:	Date of Issuance:
Contractor:	Effective Date:
Engineer:	Contractor's Project No.:
Project:	Engineer's Project No.:

The Contract is modified as follows upon execution of this Change Order:

Description:

Attachments:

CHANGE IN CONTRACT PRICE	CHANGE IN CONTRACT TIMES <i>[note changes in Milestones if applicable]</i>
Original Contract Price: \$ _____	Original Contract Times: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] from previously approved Change Orders No. ____ to No. ____: \$ _____	[Increase] [Decrease] from previously approved Change Orders No. ____ to No. ____: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
Contract Price prior to this Change Order: \$ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] of this Change Order: \$ _____	[Increase] [Decrease] of this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
Contract Price incorporating this Change Order: \$ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for Final Payment: _____ days or dates

By: _____ Engineer (if required)	By: _____ Owner	By: _____ Contractor
Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____

Approved by Funding Agency (if applicable)

By: _____	Date: _____
Title: _____	

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CERTIFICATE OF SUBSTANTIAL COMPLETION

Project: _____

Date of Issuance: _____

Owner: The Board of County Commissioners of Montgomery County, Ohio

Project No.: _____

Contract No.: _____

Contractor: _____

Engineer _____

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof.

To: The Board of County Commissioners of Montgomery County, Ohio
Owner

And To _____
Contractor

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, and that Work is hereby declared to be substantially complete in accordance with the Contract Documents on

Date of Substantial Completion

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by CONTRACTOR within _____ days of the above date of Substantial Completion.

From the date of Substantial Completion, the responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties and guarantees shall be as follows:

RESPONSIBILITIES

OWNER: _____

CONTRACTOR: _____

The following documents are attached to and made a part of this Certificate:

[For items to be attached see definition of Substantial Completion as supplemented and other specifically noted conditions precedent to achieving Substantial Completion as required by Contract Documents.]

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR's obligation to complete the Work in accordance with the Contract Documents.

Executed by ENGINEER on _____, 20____

ENGINEER

By: _____
(Authorized Signature)

CONTRACTOR accepts this Certificate of Substantial Completion on _____, 20__

CONTRACTOR

By: _____

OWNER accepts this Certificate of Substantial Completion on _____, 20__

OWNER

By: _____
(Authorized Signature)

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STATEMENT OF CLAIM FORM

Claim No. ____ for Contractor

1. Name of Contractor: _____
2. Date written claim given: _____.
3. Contractor's representative to contact regarding the claim:
Name: _____ Title: _____
Telephone No. _____ (office) FAX No. _____
E-mail: _____
4. General description of claim:

5. Contract Documents. If the claim is based upon any part or provision in the Contract Documents, including but not limited to pages in the Drawings and/or paragraphs in the Specifications, Owner-Contractor Agreement, General Conditions or Supplementary General Conditions, state upon which parts or provisions the claim is based:

6. Delay claims:
 - 6.1 Date delay commenced: _____
 - 6.2 Duration or expected duration of the delay, if known: _____
 - 6.3 Apparent cause of the delay and part of critical path affected:

 - 6.4 Expected impact of the delay and recommendations for minimizing such impact:

7. Additional compensation. Set forth in detail all additional compensation to which the Contractor believes it is entitled with respect to this claim:

8. Instructions for Completing the Statement of Claim Form ("Instructions"). The Instructions are incorporated in this Form.

9. Truth of Claim. By submitting this claim, the Contractor and its representative certify that after conscientious and thorough review and to the best of his or her knowledge and belief a) the Contractor has complied fully with the Instructions, b) the information in this State of Claim is accurate, c) the Contractor is entitled to recover the compensation in paragraph 7, and d) the Contractor has not knowingly presented a false or fraudulent claim. The Contractor by its authorized representative must acknowledge this Statement of Claim before a notary public.

Contractor: _____

By: _____

Name and Title: _____

Date: _____

CONTRACTOR'S ACKNOWLEDGMENT

State of _____,

County of _____, ss:

_____ first being sworn, states that after conscientious and thorough review, the statements made in attached Statement of Claim Form are complete and true to the best of his or her knowledge and belief.

Sworn to before me a notary public by _____ on _____, 20__.

Notary Public

WHEN COMPLETED, FORWARD A COPY OF THIS NOTICE AND STATEMENT OF CLAIM FORM TO THE OWNER AND DESIGN PROFESSIONAL.

INSTRUCTIONS FOR COMPLETING THE STATEMENT OF CLAIM FORM

1. Completing the Statement of Claim Form ("Claim Form") is a material term of the Contract. The Claim Form tells the Owner and Design Professional that the Contractor is making a Claim and that they need to act promptly to mitigate the effects of the occurrence giving rise to the Claim. The Claim Form also provides them with information so that they can mitigate such effects. The Contractor acknowledges that constructive knowledge of the conditions giving rise to the Claim through job meetings, correspondence, site observations, etc. is inadequate notice, because knowledge of these conditions does not tell the Owner and Design Professional that the Contractor will be making a Claim and most often is incomplete.
2. If the space provided in the Claim Form is insufficient, the Contractor, as necessary to provide complete and detailed information, must attach pages to the Claim Form with the required information.
3. Paragraph 4. The Contractor must state what it wants, *i.e.*, time and/or compensation, and the reason why it is entitled to time and/or compensation.
4. Paragraph 5. The Contractor must identify the exact provisions of the Contract Documents it is relying on in making its Claim. For example, if the Claim is for a change in the scope of the Contractor's Work, the Contractor must identify the specific provisions of the Specifications, and the Plan sheets and details that provide the basis for the scope change.
5. Paragraph 6. This paragraph applies to delay claims, including delays that the Contractor believes result in constructive acceleration. The Contractor must identify the cause of the delay, party or parties responsible, and what the party did or did not do that caused the delay, *i.e.*, specific work activities. The Contractor acknowledges that general statements are not sufficient, and do not provide the Owner with sufficient information to exercise the remedies available to the Owner or to mitigate the effects of the delay.

For example, if the Contractor claims a slow response time on submittals caused a delay, the Contractor must identify the specific submittals, all relevant dates, and then show on the applicable schedule, by circling or highlighting, the activities immediately affected by the delays. Also, for example, if the Contractor claims it was delayed by another Contractor, the Contractor must identify the delaying Contractor, specifically what the delaying Contractor did or did not do that caused the delay, and then show the applicable schedule, by circling or highlighting, the activities immediately affected by the delays. Further by example, if the Contractor seeks an extension of time for unusually severe weather, the Contractor must submit comparative weather data along with a record of the actual weather at the job site and job site conditions.

6. Paragraph 6.4. Time is of the essence under the Contract Documents. If there is a delay, it is important to know what can be done to minimize the impact of the delay. It therefore is important that the Contractor provide specific recommendations on how to do so.
7. Paragraph 7. The Contractor must provide a specific and detailed breakdown of the additional compensation it seeks to recover. For future compensation, the Contractor shall provide its best estimate of such compensation.
8. Paragraph 8 and Acknowledgment. By submitting this Claim, the Contractor and its representative certify that after conscientious and thorough review and to the best of his or her knowledge and belief a) the Contractor has complied fully with the Instructions, b) the information in this Claim Form is accurate, c) the Contractor is entitled to recover the compensation in paragraph 7, and d) the Contractor has not knowingly presented a false or fraudulent claim. The Contractor by its authorized representative must acknowledge this Statement of Claim before a notary public.

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SECTION 00688

CONSENT OF SURETY COMPANY TO FINAL PAYMENT

Owner ☐
Design Professional ☐
Contractor ☐
Surety ☐
Other ☐

PROJECT NAME: _____
(address):

TO OWNER:
Montgomery County Board of County
Commissioners

APPLICABLE BOND NUMBER: _____
CONTRACT FOR: _____

CONTRACTOR (name and address):

CONTRACT DATE: _____

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above,
the _____, Surety Company,

On bond of _____, Contractor, hereby approves final payment to the
Contractor, and agrees that final payment to the Contractor shall not relieve the Surety Company of any of
its obligations to the Montgomery County Board of County Commissioners, Owner, as set forth in the said
Surety Company's bond.

IN WITNESS WHEREOF,

The Surety Company has hereunto set its hand this _____ day of _____, 20__

Surety Company

Attest:
(Seal):

Signature of Authorized Representative

Title

Note: Surety shall attach valid Power of Attorney to executed Form.

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SECTION 00700

STANDARD GENERAL CONDITIONS OF THE
CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Documents or Contract Documents, a term printed with initial capital letters or with all capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda* – Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Documents or the proposed Contract Documents.
 2. *Agreement or Owner-Contractor Agreement* – The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 3. *Application for Payment* – The form acceptable to Owner which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Bid* – The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder* – An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents* – The Bidding Requirements, Bid Submittal Documents the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements* – The advertisement or invitation to bid and the Instructions to Bidders.
 8. *Change Order* – A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal* – A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. *Claim* – (a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal;

or seeking resolution of a contractual issue that Engineer has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern* – Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. (“CERCLA”); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5501 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §6901 et seq. (“RCRA”); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
12. *Contract* – The entire and integrated written contract between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.
13. *Contract Documents* – Those items so designated in the Agreement, and which together comprise the Contract. Only printed or hard copies of the items in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor’s submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.
14. *Contract Price* – The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 13.03 in the case of Unit Price Work).
15. *Contract Times* – The number of days or the dates stated in the Agreement by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work so that it is ready for final payment as evidenced by Engineer’s written recommendation of final payment.
16. *Contractor* – The individual or entity with which Owner has contracted for performance of the Work and has entered into the Agreement.
17. *Coordinating Contractor* – The Coordinating Contractor (if any) is defined in the Owner-Contractor Agreement (00510).
18. *Cost of the Work* – See Paragraph 13.01 for definition.
19. *Drawings* – The part of the Contract Documents prepared or approved by the Engineer that graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.
20. *Design Professional* – A person, firm or corporation having a contract with the Owner to furnish services as the Engineer’s independent professional associate or consultant with respect to the Project.
21. *Effective Date of the Contract* – The date, indicated in the Agreement, on which the Contract becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed by the Owner.

22. *Engineer* – The Sanitary Engineer of Montgomery County, Ohio or the Owner’s duly authorized representative.
23. *Field Order* – A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
24. *General Requirements* – Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.
25. *Hazardous Environmental Condition* – The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
26. *Laws and Regulations; Laws or Regulations* – Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
27. *Liens* – Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
28. *Milestone* – A principal event in the performance of the Work that the Contract requires Contractor to achieve by a date or by a time as defined in the Agreement.
29. *Notice of Award* – The written notice by Owner to a Bidder of Owner’s acceptance of the Bid.
30. *Notice to Proceed* – A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
31. *Owner* – The Board of County Commissioners of Montgomery County, Ohio with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
32. *Progress Schedule* – A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Times. The Progress Schedule is also referred to as the Construction Schedule.
33. *Project* – The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
34. *Project Manual* – The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions (if any), and Specifications. The contents of the Project Manual may be bound in one (1) or more volumes.

35. *Resident Project Representative* – The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or “RPR” includes any assistants or field staff of Resident Project Representative.
36. *Samples* – Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
37. *Schedule of Submittals* – A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals and the performance of related construction activities.
38. *Schedule of Values* – A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.
39. *Shop Drawings* – All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
40. *Site* – Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.
41. *Specifications* – The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
42. *Subcontractor* – An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
43. *Substantial Completion* – The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Owner, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof. Substantial Completion is further defined as (i) that degree of completion of the Project’s operating facilities or systems sufficient to provide Owner the full time, uninterrupted, and continuous beneficial operation of the Work; and (ii) all required functional, performance, and acceptance or startup testing has been successfully demonstrated for all components, devices, equipment, and instrumentation and control to the satisfaction of Owner in accordance with the requirements of the Specifications.
44. *Successful Bidder* – The Bidder who’s Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
45. *Supplementary Conditions* – The part of the Contract Documents that amends or supplements these General Conditions.

46. *Supplier* – A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
47. *Technical Data* – Those items expressly identified as Technical Data in the Contract Documents, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
48. *Underground Facilities* – All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
49. *Unit Price Work* – Work to be paid for based on unit prices.
50. *Work* – The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.
51. *Work Change Directive* – A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner, ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

- A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Documents or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:*
1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional

judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day:*

1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents; or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - c. has been damaged prior to final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).

E. *Furnish, Install, Perform, Provide:*

1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

- A. *Bonds:* When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Contractor's Insurance:* When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured identified in the Supplementary Conditions Owner-approved copies of certificates of insurance, copies of endorsements, and other evidence of insurance which either of them or any additional insured may reasonably request, which Contractor is required to purchase and maintain in accordance with Article 6.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor two (2) printed copies of the Contract Documents and one (1) copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one (1) original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

- A. *Preliminary Schedules:* Within twenty-one (21) days after the Effective Date of the Notice to Proceed (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Coordinating Contractor (if any), Engineer and Owner for timely review:
 - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including all Milestones specified in the Contract;
 - 2. a preliminary Schedule of Submittals; and
 - 3. a preliminary Schedule of Values for all the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in enough detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work. The total of the Schedule of Values prepared for the Work, as required by these Modified General Conditions, shall not exceed the Bid submitted for the Work, unless such amount is adjusted as provided in the Contract Documents.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for

handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Initial Acceptance of Schedules*

- A. At least ten (10) days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional ten (10) days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Owner.
 - 1. The Construction/Progress Schedule shall be prepared as provided in the Contract Documents.
 - 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
 - 3. For non-unit price Work, Contractor's Schedule of Values will be acceptable to Owner and Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work. Once approved by the Owner, the Contractor will not change the allocation of the Contract Price to the component parts of the Work without the Owner's written approval. The Owner and/or Engineer thereafter may from time to time require the Contractor to adjust such schedule if the Owner and/or Engineer determines it to be in any way unreasonable or inaccurate. The Contractor then shall adjust the schedule of values as required by the Owner and/or Engineer within ten (10) days.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether specifically called for at no additional cost to Owner.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Owner and/or Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

- A. Standards Specifications, Codes, Laws and Regulations
 - 1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
 - 2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

- A. *Reporting Discrepancies:*
 - 1. *Contractor's Verification of Figures and Field Measurements:* In addition to its obligations under the Instructions to Bidders, before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor

shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Owner and Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof or Contractor failed to perform its obligations under the Instructions to Bidders.
4. In addition to its obligations under the Instructions to Bidders, if Contractor proceeds with work that Contractor had actual knowledge or should have known that a conflict, error, ambiguity, or discrepancy existed as indicated above, correction or work constructed without notification to Owner and Engineer shall be at Contractor's expense, (except in an emergency as authorized by Paragraph 7.15).

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether specifically incorporated by reference as a Contract Document); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).
2. Within the Contract Documents, the requirements of the Agreement shall take precedence over the Modified General Conditions.
3. Within the Contract Documents, the Specifications shall take precedence over the Drawings.
4. Within a Contract Document, figure dimensions on Drawings shall take precedence over general Drawings. Specific instructions or specifications shall take precedence over the general instructions or specifications.

3.04 *Requirements of the Contract Documents*

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs) or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.
- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

- A. Contractor and its Subcontractors and Suppliers shall not:
 - 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or
 - 2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run in accordance with Article 4 of the Agreement.

4.02 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to such date.

4.03 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Owner and Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel. Contractor is referred to the General Requirements for additional requirements for laying out the Work.

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Construction Schedule established in accordance with the Contract Documents. See section 01310 of the Technical Specification titled "Construction Schedules."
1. The Milestone Date(s), including, but not limited to the Milestone Date for Substantial Completion shall only be changed or modified by Change Order, other Modification, or a Claim that is Finally Resolved, regardless of the date in the Construction Schedule.
 2. The float in the Construction Schedule and any updates to it shall belong to the Owner. Float shall mean the amount of time by which activities may be delayed without affecting the Contract Date for Substantial Completion.
 3. The Contractor's obligation to furnish scheduling information is a material term of its Contract. If the Contractor fails to furnish requested scheduling information in writing within five (5) days of a request for such information from the Coordinating Contractor, Engineer or Owner, the Contractor shall pay, and the Owner may withhold from the Contractor Liquidated Damages at the rate of Fifty Dollars (\$50.00) a day for each calendar day thereafter that the Contractor fails to furnish the requested information.
 4. The Contractor shall update the Construction Schedule in accordance with the Contract Documents, including Specification Section 01310, unless there is a Coordinating Contractor identified in the Agreement. If a Coordinating Contractor is identified in the Agreement, the Coordinating Contractor shall be responsible for updating the Construction Schedule.
 5. Contractor shall submit, to Owner, Engineer and Coordinating Contractor (if any) all scheduling information requested by Owner, Engineer and Coordinating Contractor, which may include, but is not limited to 1) written reports describing the activities begun or finished during the preceding week; 2) Work in progress; 3) expected completing dates for individual tasks and for the Work; 4) look ahead schedules; and, 5) Contractor's crew size and total resource hours associated with the Work.
- B. THE PERIODS OF TIME IN THE PROJECT CONSTRUCTION SCHEDULE ARE OF THE ESSENCE TO THIS CONTRACT. THE CONTRACTOR SHALL PROSECUTE ITS WORK IN ACCORDANCE WITH THE CURRENT PROJECT CONSTRUCTION SCHEDULE.
1. Notice of Delays. As a condition precedent to any increase in the Contract Price and/or Contract Times, the Contractor shall give the Owner and the Engineer verbal notice of any

delay affecting its Work within two (2) business days of the commencement of the delay. In addition, and also as a condition precedent to any increase in the Contract Price and/or Contract Times, the Contractor shall give the Owner and Engineer written notice of the delay within ten (10) business days of the commencement of the delay with specific recommendations about how to minimize the effect of the delay. The written notice of the delay shall conspicuously state that it is a "NOTICE OF DELAY." A notice of delay shall not constitute the submission of a Claim. Contract Times shall only be changed as provided in the Agreement. The Contractor acknowledges and agrees that these notice provisions are material terms of the Contract Documents and give the Owner the opportunity to take action to minimize the cost and/or effect of delays.

4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph; it being understood and agreed that the Contractor has included in the Contract Price a contingency for the risk of such delays. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
 - 1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 - 2. weather conditions as provided in Paragraph 4.05.H;
 - 3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
 - 4. acts of war or terrorism.
- D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.
- E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.
- G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph in accordance with the notice requirements in the Contract Documents.
- H. Weather Delays. When the Contractor is prevented from completing any part of the Work on the critical path within the Contract Time due to weather conditions, if a Claim is made as provided for in these Modified General Conditions, the Contract Time will be extended by one (1) day for each work day lost due to weather that delays Work on the critical path in excess of those in the following table:

Month	Number of Workdays Lost Due to Weather
January	8
February	8
March	7
April	6
May	5
June	4
July	4
August	4
September	5
October	6
November	6
December	6

- I. A work day will be lost due to weather only when weather conditions reduce production by more than 50 percent on Work on the critical path. Production shall be measured by hours worked. The Contractor shall have the burden of establishing that weather conditions reduced the production by more than 50 percent on Work on the critical path.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
- B. Upon reasonable written request, Owner shall furnish Contractor with a Notice of Commencement prepared for the Project, as provided in Specification Section 00530 and conforming to the provisions of Ohio Revised Code Section 1311.252.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. Limitation on Use of Site and Other Areas:

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all 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 any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, alleged to have been caused by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

- B. Removal of Debris During Performance of the Work: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
- C. Cleaning: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. Loading of Structures: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Owner-Contractor Agreement (Specification Section 00510) identifies:
1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;
 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
 3. Technical Data contained in such reports and drawings.
 4. It is possible that there may be other reports, and/or tests of subsurface conditions at or contiguous to the Site not prepared by or on behalf of Owner. The Owner makes no representation about such reports and/or tests, assuming they exist.
- B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data contained in such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
 2. other data, interpretations, 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, interpolations and extrapolations of Technical Data performed by Contractor to estimate locations or quantities of subsurface strata are independent factual assumptions which Owner does not warrant.

5.04 Differing Subsurface or Physical Conditions

- A. Notice by Contractor: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site either:
1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or
 2. is of such a nature as to require a change in the Drawings or Specifications; or
 3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor, as a condition precedent to any increase in the Contract Price and/or an extension of the Contract Times shall, within 48 hours after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

- B. Engineer's Review: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- C. Owner's Statement to Contractor Regarding Site Condition: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. Possible Price and Times Adjustments:
 1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
 2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew or should have known of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract

Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or

- b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Documents or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
- 3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
 - 4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 Underground Facilities

- A. Contractor's Responsibilities: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, or by others. Unless it is otherwise expressly provided elsewhere in these Modified General Conditions:
 - 1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and
 - 2. the cost of all the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. protecting all Underground Facilities in a manner at least as cautious and protective of safety and of underground facilities as those methods identified in Ohio Revised Code Sections 3781.25 and 3781.30;
 - b. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 - c. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. Notice by Contractor: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

- C. **Engineer's Review:** Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. **Owner's Statement to Contractor Regarding Underground Facility:** After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. **Possible Price and Times Adjustments:**
 - 1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
 - b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and
 - d. Contractor gave the notice required in Paragraph 5.05.B.
 - 2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
 - 3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 Hazardous Environmental Conditions at Site

- A. **Reports and Drawings:** The Agreement identifies:

1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
 2. Technical Data contained in such reports and drawings.
- B. Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Contract Documents with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 2. other data, interpretations, 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.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition and impose a set-off against payments to account for the associated costs.

- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.
- H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- I. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, 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 a Hazardous Environmental Condition created by Contractor or anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- J. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6 – BONDS AND INSURANCE

6.01 Performance, Payment, and Other Bonds

- A. Contractor shall furnish a Performance bond and a Payment bond in the amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. Such bonds shall be in the form that meets the requirements of the Ohio Revised Code. If the Contractor submitted a combined Bid Guaranty and Contract Bond with its bid for the Work, that form of Bond shall satisfy the Contractor's requirement to provide a Performance and Payment Bond. . Contractor shall also furnish such other bonds as are required by the Contract Documents.
- B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury and meet the other requirements of the Contract Documents. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's

authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

- C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.
- D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.
- E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.
- F. Upon request, Owner shall provide a copy of the Payment Bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.
- G. Material Default or Termination. If the Owner notifies the Contractor's surety that the Contractor is in material default, the surety will complete its investigation of the claimed material default within 21 days. The surety is advised to start looking for a replacement contractor upon notice of material default. As part of its investigation, the surety shall promptly visit the offices of the Contractor, Engineer, and Owner to inspect and copy the available Project records. The Owner, Engineer, and Contractor, upon written request by the surety, shall make such records available during regular business hours for such inspection and copying. The Owner and Engineer's making such records available as provided herein shall satisfy the Owner's obligation to the surety to furnish documents for the investigation. The surety will provide the Owner with the results of its investigation, including any written reports or documents.
 - 1. If the Owner terminates the Contract and the surety proposes to take over the Work, the surety shall do so no later than the expiration of the 21-day investigation period or ten (10) days after the date the Owner terminates the Contract, whichever is later. If the Owner terminates the Contract, and the surety proposes to provide a replacement contractor, the replacement contractor shall not be the Contractor, or a contractor comprised of mostly Contractor's employees, unless the Owner agrees in writing. In the event the Surety takes over the Project, the surety's obligation shall not be limited to the penal sum of the Bond.
 - 2. If the surety does not propose an acceptable contractor as required by this Paragraph 6.01.G, the Owner may complete the Work by such means as it deems appropriate. In the event the Owner agrees to accept a replacement contractor, the replacement contractor shall furnish its own bond for the replacement contractor's scope of work, and neither the Contractor nor the surety shall be relieved of their obligations under the Contract Documents.
 - 3. This Paragraph 6.01.G is in addition to any other rights of the Owner under the Contract Documents and is not intended to create any rights of the surety, including but not limited to the right to take over the Contractor's obligations.

4. In the event of the Contractor's termination and if the surety does not take over the Work as provided in this Paragraph 6.01.G, the Owner may take possession of and use all materials, facilities, and equipment at the Project Site or stored off-site for which Owner has paid in whole or in part.

6.02 *Insurance—General Provisions*

- A. Contractor shall obtain and maintain insurance as required in this Article and in the Contract Documents.
- B. All insurance required by the Contract to be purchased and maintained by Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Modified General Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-IX or better.
- C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract Documents), three (3) certificates of insurance, copies of endorsements, or when specifically requested by the Owner, three (3) certified copies of the insurance policies and a receipt evidencing full payment on the premiums, and other evidence of insurance requested by Owner establishing that Contractor has obtained and is maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- D. Failure of Owner to demand such certificates or other evidence of full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to obtain and maintain such insurance.
- E. If either party does not purchase or maintain all the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- F. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.
- G. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.
- H. By requiring such insurance and insurance limits herein, Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.

- I. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract Documents.

6.03 *Contractor's Insurance*

- A. Workers' Compensation: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.
 - 2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).
 - 3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement).
 - 4. Foreign voluntary worker compensation (if applicable).
- B. Commercial General Liability – Claims Covered: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:
 - 1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.
 - 2. claims for damages insured by reasonably available personal injury liability coverage.
 - 3. claims for damages, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- C. Commercial General Liability – Form and Content: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:
 - 1. Products and completed operations coverage:
 - a. Such insurance shall be maintained for three years after final payment (if applicable).
 - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract Documents) evidence of continuation of such insurance at final payment and three years thereafter (if applicable).
 - 2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 - 3. Broad form property damage coverage.
 - 4. Severability of interest.
 - 5. No exclusions for underground, explosion, and collapse coverage.
 - 6. Personal injury coverage.

7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
 8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.
 9. The policy shall be endorsed to include a definition of "Occurrence" to include an accident, including continuous or repeated exposure to substantially the same general harmful conditions. Faulty workmanship does not constitute an occurrence. When faulty workmanship performed causes bodily injury or causes property damage to property other than your work, bodily injury or property damage will be considered caused by an occurrence.
- D. Automobile liability: Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.
- E. Umbrella or excess liability: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.
- F. Contractor's pollution liability insurance: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.
- G. Additional insureds: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions or elsewhere in the Contract Documents; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.
- H. Contractor's professional liability insurance: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of three years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

- I. General provisions: The policies of insurance required by this Paragraph 6.03 shall:
1. Include at least the specific coverages provided in this Article.
 2. Be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.
 3. Contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least sixty (60) days prior written notice has been given to Contractor, except when cancellation is for non-payment of premium, then ten days prior notice may be given. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.
 4. Remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.
 5. Be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.
 6. Include products and completed operations insurance \$2,000,00 Aggregate.
 7. Include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 5.02 and 7.18.
 8. With respect to products and completed operations insurance remain in effect for at least three years after final payment.
 - a. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions or elsewhere in the Contract Documents, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one (1) year thereafter.
- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.
- K. The following provisions shall also apply to the insurance provided by the Contractor:
1. Contractor's insurance shall be primary and non-contributory.
 2. Insurance policies shall be written on an occurrence basis only.
 3. The Contractor shall require all Subcontractors to provide Workers' Compensation, CGL, and Automobile Liability Insurance with the same minimum limits specified in the Supplementary Conditions or elsewhere in the Contract Documents, unless the Owner agrees to a lesser amount.

4. Owner shall be named as a certificate holder on the policies of insurance maintained by Contractor. The Contractor shall provide each additional insured with a certificate of insurance.
 5. The additional insured endorsement shall be ISO 20 10 10 01 and CG 20 37 10 01 or their equivalents, so that Completed Operations liability extends to the additional insured after the completion of the Project.
- L. In all cases, the insurance shall be issued by an insurance company authorized to conduct business in the State of Ohio, and specifically with the Board of County Commissioners of Montgomery County, Ohio, and having an AM Best rating of not less than A "IX". The county in no way warrants that the above-required minimum insurer rating is sufficient to protect the Contractor from potential insurer insolvency. In the remarks section of the Certificate of Insurance, the associated Bid Number, Job Number and/or project name shall be referenced. All insurance policies required by this article shall be subject to a sixty (60) day written notice of cancellation or diminution of coverage to the Board

6.04 Property Insurance

- A. Builder's Risk: Unless otherwise provided in the Contract Documents, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Contract Documents or required by Laws and Regulations). This insurance shall:
1. include the Owner, Engineer, and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Contract Documents to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding sections in the Contract Documents, the parties required to be insured shall collectively be referred to as "insureds."
 2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Contract Documents. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.
 3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are

not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).
 5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
 6. extend to cover damage or loss to insured property while in transit.
 7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
 8. allow for the waiver of the insurer's subrogation rights, as set forth below.
 9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
 10. not include a co-insurance clause.
 11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
 12. include performance/hot testing and start-up.
 13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. Contractor shall maintain adequate commercial property insurance covering equipment, fixtures, improvements and betterments Contractor owns, rents, or leases. Coverage shall be for full replacement cost.
- C. Contractor may, at its option, purchase business income, extra expense or similar coverage as part of this commercial property insurance, and in no event shall Montgomery County be liable for any business interruption or other consequential loss sustained by Contractor, whether or not it is insured, even if such loss is caused by the negligence of Montgomery County, its employees, officers, directors or agents
- D. Notice of Cancellation or Change: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least sixty (60) days prior written notice has been given to the purchasing policyholder except when cancellation is for non-payment of premium, then ten (10) days prior notice may be given. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

- E. Deductibles: The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible. The deductible shall not exceed \$1,000.
- F. Partial Occupancy or Use by Owner: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
- G. Additional Insurance: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.
- H. Insurance of Other Property: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.05 Waiver of Rights

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.06 Receipt and Application of Property Insurance Proceeds

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.
- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 Supervision and Superintendence

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances. The superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

7.02 Labor; Working Hours

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, Shut Down Dates as defined in the Agreement, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, Shut Down Dates as defined in the Agreement, or legal holidays only with Owner's written consent, which will not be unreasonably withheld. Contractor (and Subcontractor) regular working hours consist of 8 up to 10 working hours within an 11-hour period between 7:00 a.m. and 6:00 p.m., on a regularly scheduled basis, excluding Saturday, Sunday, and holidays. Overtime work is work in excess of 40 hours per week. Contractor must receive advanced written approval from the Owner prior to performing work on weekends or

County Holidays. Approval of such weekend and/or holiday work is in the Owner's sole discretion.

- C. If Contractor wishes to perform regular Work at times other than regular working hours, Contractor shall be required to pay the Owner for the services of the Resident Project Representative and the Engineer at established rates on record in the office of Montgomery County Environmental Services.
 - 1. Contractor shall give a minimum of forty-eight (48) hours' notice of intent to work at times other than regular working hours to the Resident Project Representative and Engineer.
 - 2. Engineer has the right to deny permission, with due cause, for the Contractor to work at times other than regular working hours.

7.03 Services, Materials, and Equipment

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment. Contractor warrants that all materials and equipment are suitable and fit for the intended use of such materials and equipment and are free from defects in material, workmanship, or design. The foregoing applies whether the materials or equipment are specified in the Contract Documents.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 "Or Equals"

- A. Substitutions prior to the receipt of bids shall be governed by the Instructions to Bidders. Substitutions after the entry into the Agreement shall be governed by these Modified General Conditions. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that:

- 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
 - 3) it has a proven record of performance and availability of responsive service; and
 - 4) it is not objectionable to Owner.
- b. Contractor certifies that, if approved and incorporated into the Work:
- 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. Contractor's Expense: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.
- C. Engineer's Evaluation and Determination: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.
- D. Effect of Engineer's Determination: Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding and may not be reversed through an appeal under any provision of the Contract Documents.
- E. Treatment as a Substitution Request: If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 Substitutes

- A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.
1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.
 2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - a. shall certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design,
 - 2) be similar in substance to that specified, and
 - 3) be suited to the same use as that specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,
 - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
 - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from that specified, and
 - 2) available engineering, sales, maintenance, repair, and replacement services.
 - d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. Engineer's Evaluation and Determination: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. Special Guarantee: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. Reimbursement of Engineer's Cost: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract

Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

- E. Contractor's Expense: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. Effect of Engineer's Determination: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 Concerning Subcontractors, Suppliers, and Others

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.
- B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract Documents to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.
- E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.
- F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, Contractor shall not be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement.
- G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

- H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.
- J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
- K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
- L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.
- N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.
- O. Nothing in the Contract Documents:
 - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor
 - 2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 Patent Fees and Royalties

- A. Contractor shall pay all license fees and royalties 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 for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use 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 Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims,

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 any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.08 Permits

- A. Owner has obtained or will obtain permits for the Project as set forth in the Supplementary Conditions. Contractor shall secure and pay for all other permits not obtained by the Owner as are necessary to complete the Project. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.
- B. A copy of each permit is available at Owner's office. Contractor shall examine the permits and conform to the requirements contained therein, and such requirements are hereby made part of these Contract Documents as though the same were set forth herein. Failure to examine the permit(s) will not relieve Contractor from compliance with the requirements stated therein.

7.09 Taxes

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.
- B. Materials purchased for use or consumption in connection with the proposed Work will be exempt from the State of Ohio Sales Tax, as provided in Section 5739.02 of the Ohio Revised Code, and also from the State of Ohio Use Tax, as provided in Section 5741.01 of the Ohio Revised Code. A Construction Tax Exempt Certificate is included with the Bid Documents.
- C. Purchases by the Contractor of expendable items, such as form lumber, tools, oil, greases, fuel, or equipment rentals, are subject to the application of Ohio Sales or Use Taxes.
- D. Contractor shall withhold any income taxes due to the Owner for wages, salaries, and commissions paid to its employees for work done under this Agreement and further agrees that any of its subcontractors shall, by the terms of its subcontract, be required to withhold any such income taxes due for work performed under this Agreement.

7.10 Laws and Regulations

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, 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 such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the

Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

- C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within thirty (30) days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.
- D. Prevailing Wage Rates. If indicated in the Agreement or Instructions to Bidders, each laborer, worker, or mechanic employed by Contractor, Subcontractor, or other persons performing Work on the Project shall be paid not less than the applicable prevailing rate of wages pursuant to Ohio Revised Code Chapter 4115.

7.11 Record Documents

- A. Contractor shall maintain in a safe place at the Site two printed record copies of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. The Contractor shall deliver these record documents, samples, and shop drawings to the Engineer, no later than the date for Substantial Completion, for the Engineer's review and transmittal to the Owner.

7.12 Safety and Protection

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
 - 1. all persons on the Site or who may be affected by the Work;
 - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when

- prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Contract Documents identify any Owner's safety programs that are applicable to the Work.
 - D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
 - E. As part of the required project submittals, Contractor shall submit a Site-Specific Safety Plan. The Site-Specific Safety Plan is to be specific, addressing anticipated/potential hazards that will be encountered while performing the contracted work. The Plan is to identify the procedures and methods for controlling the project-specific safety hazards identified. Review of this Site-Specific Safety Plan by the Owner or Engineer does NOT release the Contractor of responsibility. The duty and liability for safety shall remain with the Contractor to ensure compliance with all federal, state and local safety laws and regulations including, but not limited to, OSHA requirements.
 - F. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
 - G. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
 - H. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 Safety Representative

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.
- B. Contractor shall keep at the Site at all times during the progress of the Work as required by law a competent person to comply with OSHA trenching and excavation requirements. The competent person shall be one who is capable of identifying existing and predictable hazards in the surrounding, or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. Neither the Owner nor the Engineer will be considered a competent person under the terms of this contract.

7.14 Hazard Communication Programs

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 Emergencies

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.16 Shop Drawings, Samples, and Other Submittals

- A. Shop Drawing and Sample Submittal Requirements:

- 1. Before submitting a Shop Drawing or Sample, Contractor shall have:

- a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

- 2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.

- 3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

- B. Submittal Procedures for Shop Drawings and Samples: Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

- 1. Shop Drawings:

- a. Contractor shall submit the number of copies required in the Specifications.
 - b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.
2. Samples:
 - a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.
3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. Other Submittals: Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.
- D. Engineer's Review:
 1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.
 3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
 4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.
 5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.
 6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.
8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

E. Resubmittal Procedures:

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.
2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than the number of submittal reviews specified in Paragraph 15.01.E.4 of these Modified General Conditions. Engineer will record Engineer's time for reviewing a subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time in accordance with Paragraph 15.01.E.4. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 Contractor's General Warranty and Guarantee

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
 1. observations by Engineer;
 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal;
 6. the issuance of a notice of acceptability by Engineer;
 7. any inspection, test, or approval by others; or
 8. any correction of defective Work by Owner.
- D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.
- E. Upon final payment, the Contractor must assign and transfer to Owner all guarantees, warranties, and agreements from and with all contractors, subcontractors, vendors, suppliers, and manufacturers regarding their performance, quality of workmanship, or quality of materials supplied in connection with the work. Contractor represents and warrants that all such guarantees, warranties, and agreements will be in place and enforceable by the Owner in accordance with their terms. The Owner, however, will not assume through any assignment or transfer required under this subparagraph any of the Contractor's payment obligations to any entities.

7.18 Indemnification

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims (whether alleged or proven), demands, 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 performance of the Work or any breach of Contractor's obligations under the Contract Documents, including but not limited to the breach of any warranty provided in the Contract Documents.
- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 Delegation of Professional Design Services

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.

- B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 Other Work

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.
- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render

it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

8.02 Coordination

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the Owner will provide for the coordination of the work at the Site in the Contract Documents.

8.03 Legal Relationships

- A. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.
- B. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.
- C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify Owner and Engineer as required under Paragraph 7.18.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 Communications to Contractor

- A. Except as otherwise provided in these Modified General Conditions, Owner shall issue all communications to Contractor through Engineer or the Resident Project Representative.

9.02 Replacement of Engineer

- A. Owner may at its discretion appoint an engineer to replace Engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

- 9.03 Furnish Data
- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.
- 9.04 Pay When Due
- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.
- 9.05 Lands and Easements; Reports, Tests, and Drawings
- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.
- 9.06 Insurance
- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.
- 9.07 Change Orders
- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.
- 9.08 Inspections, Tests, and Approvals
- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.
- 9.09 Limitations on Owner's Responsibilities
- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- 9.10 Undisclosed Hazardous Environmental Condition
- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.
- 9.11 Evidence of Financial Arrangements
- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 Safety Programs

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 Owner's Representative

- A. Engineer will be Owner's representative during the construction period. The Engineer's duties and responsibilities during the construction period are in addition to the duties and responsibilities of the Owner's Representative, as referenced in the Agreement. The duties and responsibilities and the limitations of authority of Engineer as a representative of the Owner during construction are set forth in the Contract Documents and will not be changed without written consent of Owner and Engineer.

10.02 Visits to Site

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 Project Representative

- A. Owner may furnish a Resident Project Representative to assist Engineer at the Site, assist Engineer in providing more extensive observation of the progress and quality of the Work, and assist in carrying out the Engineer's other responsibilities under the Contract Documents and its agreement with the Owner.
- B. The duties and responsibilities of the Resident Project Representative may include, but not be limited to, the following:
 - 1. Review schedules and amendment thereto.
 - 2. Attend conferences and meetings with Contractor.

3. Serve as liaison between Owner, Engineer, and Contractor.
 4. Conduct on-site observation of the work.
 5. Observe tests, equipment, and system startups.
 6. Report to Engineer and Owner when clarifications and interpretations of the Contract Documents are needed. Consider, evaluate, and report to Engineer and Owner, Contractor's requests for modification.
 7. Maintain orderly records, keep a daily log (when on a part-time basis, keep log for days visiting site).
 8. Before project completion, prepare final list of items to be completed or corrected and make recommendations to Owner concerning acceptance of the Work.
 9. Review Payment Applications from Contractor.
- C. The Resident Project Representative shall not:
1. Authorize any deviation from the Contract Documents or substitutions of materials or equipment, unless authorized by Owner.
 2. Undertake any of the responsibilities of Contractor, Subcontractor, or Contractor's superintendent.
 3. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences, or procedures of construction.
 4. Advise on, issue directions regarding, or assume control over safety precautions and programs in connection with the Work.
 5. Accept shop drawing or sample submittals from anyone other than Contractor.
 6. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
 7. Authorize Owner to occupy the Project in whole or in part.
 8. Participate in specialized field or laboratory tests or inspections conducted by others except as specifically authorized by Engineer.

10.04 Rejecting Defective Work

- A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 Shop Drawings, Change Orders and Payments

- A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.
- B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.
- C. Engineer's authority as to Change Orders is set forth in Article 11.

- D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 Determinations for Unit Price Work

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.
- B. Unit Price Work for which a typical cross section or other detail from the Contract Documents applies shall be paid only up to the quantity determined by using the dimensions provided in the typical cross section or other detail. By way of example, this provision means that if a typical trench width detail in the Drawings shows a maximum width of 30 inches, all pay quantities associated with the actual work of constructing the detail shall be calculated using a trench width not greater than 30 inches. This means that the actual pay quantity could also be less than that based upon a 30-inch-wide trench, if the actual trench width is smaller and otherwise in conformance with the Contract Documents, but the Contractor would not be paid more if the actual trench width exceeds 30 inches. Contractor is responsible for determining what actual trench width may be required due to field conditions and applicable laws and regulations existing at the time of its bid.

10.07 Decisions on Requirements of Contract Documents and Acceptability of Work

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 Limitations on Engineer's Authority and Responsibilities

- A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.
- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

- E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 Compliance with Safety Program

- A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 Amending and Supplementing Contract Documents

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

1. Change Orders:

- a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order as provided in Specification Section 00685. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
- b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.

- 2. Work Change Directives: A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than thirty (30) days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than sixty (60) days after issuance of the Work Change Directive.

- 3. Field Orders: Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order, as provided in Specification Section 00684 and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 Owner-Authorized Changes in the Work

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations. The agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including but not limited to, all direct, indirect, and cumulative costs associated with such change and all adjustments to the Contract Sum and the Date for Substantial Completion.
- B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of Work Change Directive, a Claim may be made therefor as provided in Article 12.

11.03 Unauthorized Changes in the Work

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 Change of Contract Price

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:
 - 1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or
 - 2. where the parties do reach an agreement to a lump sum, then by that mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or
 - 3. where the parties do not reach an agreement to a lump sum, then based on the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).
- C. Contractor's Fee: When applicable, the Contractor's fee for overhead and profit shall be determined as follows, and is the maximum total allowable amount:

1. a mutually acceptable fixed fee; or
2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;
 - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.04.C.2.a and 11.04.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
 - d. no fee shall be payable based on costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
 - f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed based on the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 Change of Contract Times

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.
- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 Change Proposals

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. Procedures: Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 7 calendar days after the start of the event giving rise thereto. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 7 calendar days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal and consider any comments or response from Owner regarding the Change Proposal.
 2. Engineer's Action: Engineer will review each Change Proposal and, within 7 calendar days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not act on the Change Proposal within 7 calendar days, then as a result of Engineer's inaction the Change Proposal is deemed denied.
 3. Binding Decision: Engineer's decision will be final and binding upon Contractor, unless Contractor files a Claim under Article 12.
- B. Resolution of Certain Change Proposals: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 Execution of Change Orders

- A. Owner and Contractor shall execute appropriate Change Orders covering:
1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work performed in accordance with a Work Change Directive;
 2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and
 4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 Notification to Surety

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change. Failure to provide notice to the surety of any such change shall not exonerate the surety from its obligations under the bond.

ARTICLE 12 – CLAIMS

12.01 Claims

- A. Claims Process: The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:
 - 1. Contractor demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;
 - 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and
- B. Submittal of Claim:
 - 1. By Contractor - As a condition precedent to a change in the Contract Price or the Contract Terms, for each Claim the Contractor shall deliver, 1) Change Proposal in accordance with Article 11.06; and, 2) a fully completed Statement of Claim Form, a copy of which form is a Contract Document and is included at Specification Section 00687, to the Engineer and the Owner, within 30 calendar days of the start of the underlying cause of the Claim. The Contractor shall be responsible for substantiating its Claim. The Contractor's failure to deliver a Change Proposal in accordance with Article 11.06 and a fully completed Statement of Claim form in accordance with Article 12.01 shall be an irrevocable waiver of Contractor's right to any form of additional compensation, be it in time or money, arising out of the Claim or the circumstances underlying the Claim. Further, Contractor's obligation to deliver a Change Proposal in accordance with Article 11.06 and a fully completed Statement of Claim form within such 30-day period is a material term of the Contract Documents and provides the Owner with the opportunity to mitigate its damages.
 - 2. By Owner - As a condition precedent to a change in the Contract Price or Contract Times or a recovery of damages against the Contractor, the Owner will give the Contractor written notice of a Claim. The Owner shall be responsible for substantiating its claim.
- C. Review and Resolution: Engineer will review each Claim from Contractor and, within 14 calendar days after receipt of the Statement of Claim Form, take one of the following actions in writing:
 - 1. deny the Claim in whole or in part;
 - 2. approve the Claim, or
 - 3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further

resolution of the Claim, such notice shall be deemed a denial. In the event the Engineer does not act on a Claim within said 14 days, the Claim shall be denied.

- D. Final and Binding Results: Engineer's written action under Paragraph 12.01.C.3 or denial pursuant to Paragraphs 12.01.C.1 will be final and binding upon Contractor, unless Contractor invokes the dispute resolution procedures set forth in Article 17.
- E. False or Fraudulent Claim. 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 Owner harmless from all costs and expenses, including Owner'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.
- F. Claim Documentation. Within ten (10) days of written request from the Owner, Contractor shall make available to Owner or its representative any books, records, or other documents in its possession or to which it has access, including but not limited to Contractor's daily logs/reports, original estimates of Work and applicable agreements, correspondence with subcontractors and suppliers, internal correspondence (including e-mail), accounting records, and other information from which the Contractor's records, and other information from which the Contractor's costs may be derived. To the extent permitted by law, the Owner shall keep the Project accounting records and estimate for the Project confidential. As requested by the Owner, the Contractor shall provide such documents and information in paper copies and/or computer format (including the format of the Contractor's accounting software and/or ASCII format). The Contractor's provision of the requested documents and information shall be a condition precedent to any further proceeding under the Contract Documents or to payment of an Application for Payment.
- G. Failure to provide the requested documents shall be a material breach of the Contract, and Contractor shall indemnify Owner for all of Owner'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 Contractor's failure to comply with this provision. If the Contractor fails to provide the requested documents, the Contractor shall be precluded from presenting such documents in any subsequent dispute resolution proceedings, if the data was reasonably available at the time of the request.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES

13.01 Cost of the Work

- A. Purposes for Determination of Cost of the Work: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
 - 1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined based on Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. Costs Included: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:
1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned based on their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.
 2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
 3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid based on Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
 4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
 5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost,

less market value, of such items used but not consumed which remain the property of Contractor.

c. Construction Equipment and Machinery

- 1) Rentals of all construction equipment and machinery, and the parts thereof in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
 - 2) Costs for equipment and machinery owned by Contractor and used on the Work will be paid at a rate shown for such equipment in the latest edition of the Associated Equipment Distributors' rental rate manual. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. Costs will include the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, shall cease to accrue when the use thereof is no longer necessary for the changed Work. Equipment or machinery with a value of less than \$1,000 will be considered small tools. Costs for equipment and machinery owned by Contractor for which Contractor is seeking monetary compensation due to the equipment and machinery being idled through no cause of Contractor will be paid at half of the Associated Equipment Distributors' rate.
- d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
- e. Fees for permits and licenses.
- f. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
- g. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for determining Contractor's fee.
- h. The cost of utilities, fuel, and sanitary facilities at the Site.
- i. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

- j. The portion of the costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain, that can be attributed to this Contract.

C. Costs Excluded: The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. Contractor's Fee: When the Work is performed based on cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined based on Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. Documentation: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 Allowances

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. Cash Allowances: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment because of any of the foregoing will be valid.
- C. Contingency Allowance: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor because of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. Contractor shall not be paid for any Unit Price Work that represents an actual quantity greater than 100% of the estimated quantity, without a Change Order. The Contractor shall maintain such records as required to track the quantities of Unit Price Work in anticipation of exceeding the 100% threshold.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.
- E. Within thirty (30) days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:
 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;
 2. there is no corresponding adjustment with respect to any other item of Work; and
 3. Contractor believes that it is entitled to an increase in Contract Price because of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 Access to Work

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

14.02 Tests, Inspections, and Approvals

- A. All Work is subject to testing to indicate compliance with Contract Document requirements. Duplicate copies of test results required shall be submitted to Engineer. Testing laboratories used by Contractor are subject to the approval of Owner. Tests and inspection of work may be conducted by Owner or an independent laboratory employed by Owner. Tests may also be performed in the field by Engineer as a basis for acceptance of the Work. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests and shall cooperate with inspection and testing personnel to facilitate required inspections and tests. Samples required for testing shall be furnished by Contractor at no cost to Owner. If completed Work does not conform to specification requirements during the initial test, the Work shall be corrected and retested for conformance. The entire cost of retesting completed Work shall be borne by Contractor. This shall include the extra cost for inspection to Owner which will be deducted from the final amount due Contractor.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
 - 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 - 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 - 3. by manufacturers of equipment furnished under the Contract Documents;
 - 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer. Tests required by the Contract Documents to be performed by Contractor that require test certificates to be submitted to Owner and Engineer for acceptance shall be made by an independent testing laboratory or agency licensed or certified in accordance with Laws and Regulations and applicable state and local statutes. In the event state license or certification is not required, testing laboratories or agencies shall meet the following applicable requirements:

- a. "Recommended Requirements for Independent Laboratory Qualification," published by the American Council of Independent Laboratories.
 - b. Basic requirements of ASTM E329, "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials used in Construction" as applicable.
 - c. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Institute of Standards and Technology or accepted values of natural physical constants.
- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Owner or Engineer, Contractor shall, if requested by Owner or Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Owner and Engineer timely notice of Contractor's intention to cover the same and Owner and Engineer had not acted with reasonable promptness in response to such notice.

14.03 Defective Work

- A. Contractor's Obligation: It is Contractor's obligation to assure that the Work is not defective.
- B. Engineer's Authority: Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. Notice of Defects: Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. Correction, or Removal and Replacement: Promptly after receipt of written notice of defective Work and so as not to delay the Project, Contractor shall correct all such defective Work, whether fabricated, installed, or completed, or, if Owner or Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. Preservation of Warranties: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. Costs and Damages: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising

out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 Acceptance of Defective Work

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 Uncovering Work

- A. Engineer has the authority to require special inspection or testing of the Work, whether the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.
 - 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
 - 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within thirty (30) days of the determination that the Work is not defective.

14.06 Owner May Stop the Work

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, fails to comply with any requirements of the Contract Documents, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them. Contractor shall not be entitled to an adjustment in contract price or contract times for delay, disruption, and interference resulting from an order from the Owner to stop the work for any reason contained within this section that are caused by or within the control of the Contractor. Delay, disruption, and interference attributable to and within the control of any Subcontractor shall be deemed to be within the control of Contractor.

14.07 Owner May Correct Defective Work

- A. If Contractor fails within two (2) business days of a written notice from Owner or Engineer, or such longer time as may be stated in such notice, to correct, or take reasonable steps to commence to correct, defective Work, or to remove and replace, or take reasonable steps to remove and replace, rejected Work in accordance with Paragraph 14.03.D or as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may correct or remedy any such deficiency. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor all the 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) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07. If payments then or thereafter due the Contractor are not enough to cover such amounts, the Contractor shall pay the difference to the Owner. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.
- B. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 Progress Payments

- A. Basis for Progress Payments: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Owner. The Owner-approved version of the Application for Payment

form, which includes information on completed Schedule of Values items, is to be used by the Contractor when making an Application for Progress Payment. Progress payments because of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. Applications for Payments:

1. At least by the 20th day of the month (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment (including a Schedule of Values described in Paragraph 2.05.A of the Modified General Conditions) filled out and signed by Contractor covering the Work completed as of the date of the Application, and any other supporting documentation required by the Contract Documents or by the Engineer. The Application for Payment will be in the form and submitted with the number of copies of it and all related documents as required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner. Each Application for Payment shall include a Contractor's Affidavit with List of Subcontractors and Suppliers and Any Amounts Withheld (00680).
2. Beginning with the second Application for Payment, each Application shall include Contractor's Affidavit with List of Subcontractors and Suppliers with Amounts Withheld (00680) including a certification that Contractor has paid all of its subcontractors and suppliers who were due to be paid with the proceeds of the prior Application for Payment; and, Contractor's Waiver and Release Agreement (00681), for each of its Subcontractors and Suppliers, a Subcontractor's - Supplier's Waiver and Release Agreement (00682) all using the forms provided by Owner and included in the Project Manual.
3. Retainage. Partial payments to Contractor for labor performed shall be made at the rate of 92 percent of the amount invoiced through the Application for Payment that shows the total Contract Completion at 50 percent or greater, pursuant to Ohio Revised Code Section 153.14. After the Contract is 50 percent complete as evidenced by payments in the amount of at least 50 percent of the Contract Price to Contractor, no additional funds shall be retained from payments for labor.
4. Contractor shall submit one (1) original (unless a different quantity is otherwise agreed upon) on 8-1/2 by 11 paper of each lien waiver submitted.
5. Contractor shall submit one (1) original (unless a different quantity is otherwise agreed upon) of each pay request for approval.
6. No advanced payment for shop drawing preparation will be made. Shop drawing costs will be paid when equipment and materials are delivered and suitably stored on the site.
7. All stored equipment and materials for which payment is requested shall have one (1) original (unless a different quantity is otherwise agreed upon) of invoices included with

the pay request. Equipment shall be identified thoroughly on the invoices, including serial numbers.

8. Payment for the stored equipment and material which are on the site shall not exceed the invoiced amount for each item, less the Contract retainage. The overhead and profit for the stored items shall not be invoiced until the item is installed.
9. Payment for off-site storage is normally reserved for sensitive or very large pieces of equipment that in Engineer's opinion would not be practical to have stored on the site. Payment for off-site stored items shall be limited to 75% of the invoiced value of the item, less Contract retainage. Contractor shall reimburse Owner the Cost of inspecting off-site stored items. When off-site storage is approved, Contractor shall provide Insurance Certificates and Document of Ownership to Owner.

C. Review of Applications:

1. Engineer will, within ten (10) days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid because of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
 5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
 6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents; or
 - f. the Contractor is in default of any other Agreement it has with the Owner.
- D. Payment Becomes Due:
1. Thirty days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.
- E. Reductions in Payment by Owner:
1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. claims have been made against Owner because of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or

damages because of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

- b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. the Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. the Contract Price has been reduced by Change Orders;
 - i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
 - j. liquidated damages have accrued because of Contractor's failure to achieve Milestones, Substantial Completion, or completion of the Work;
 - k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - l. there are other items entitling Owner to a set off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.
 3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.
 4. Items entitling Owner to retain set-offs from the amount recommended include, but are not limited, to the following:

- a. Owner compensation to Engineer at an average rate of \$200 per each extra personnel hour for labor plus expenses, if applicable, because of the following Contractor-caused events:
 - 1) Return visits to manufacturing facilities to witness factory testing or retesting;
 - 2) Submittal review more than two reviews by Engineer for substantially the same Submittal, in accordance with Paragraph 7.16.E of these Modified General Conditions;
 - 3) Evaluation of proposed substitutes and in making changes to Contract Documents occasioned thereby, in accordance with Paragraph 7.05 of these Modified General Conditions; and
 - 4) Overtime worked by Contractor necessitating Engineer or anyone else to work overtime in accordance with Paragraph 7.02 of these Modified General Conditions.
- b. Liability for liquidated damages incurred by Owner as set forth in the Contract Documents.

15.02 Contractor's Warranty of Title

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 Substantial Completion

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall inspect the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected)

reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
- F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.
- G. Time for Completion of Items on Tentative List and Remedies. The time fixed by the Engineer for the completion of all items on the list accompanying the tentative certificate of Substantial Completion shall not be greater than thirty (30) days. The Contractor shall complete all items on the list within such 30-day period. If the Contractor fails to do so, the Owner in its discretion may perform the Work by itself or others and the cost thereof shall be charged to the Contractor. The Contractor irrevocably designates the Owner as the Contractor's attorney-in-fact to execute a Change Order deducting such cost from the balance of the Contract Price and any additional costs or expenses incurred by the Owner arising out of or related to the failure of the Contractor to complete such items, including but not limited to attorneys', consultants', and Engineer's fees. The Contractor's warranties under the Contract Documents shall remain in full force and effect and cover any remedial Work, even if performed by others. If more than one inspection by the Engineer for purposes of evaluating corrected Work is required, it will be performed at the Contractor's expense.

15.04 Partial Use or Occupancy

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 - 1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.
 - 2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall inspect that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
4. Owner may at any time request Contractor in writing to permit Owner to take over operation of any part of the Work although it is not substantially complete. A copy of such request will be sent to Engineer, and within a reasonable time thereafter, Owner, Contractor, and Engineer shall inspect that part of the Work to determine its status of completion and will prepare a list of the items remaining to be completed or corrected thereon before final payment. If Contractor does not object in writing to Owner and Engineer that such part of the Work is not ready for separate operation by Owner, Engineer will finalize the list of items to be completed or corrected and will deliver such lists to Owner and Contractor together with a written recommendation as to the division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, maintenance, utilities, insurance, warranties, and guarantees for that part of the Work which will become binding upon Owner and Contractor at the time when Owner takes over such operation (unless they shall have otherwise agreed in writing and so informed Engineer). During such operation and prior to Substantial Completion of such part of the Work, Owner shall allow Contractor reasonable access to complete or correct items on said list and to complete other related Work.
5. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 Final Inspection

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 Final Payment

- A. Application for Payment:
 1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.
 2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;

- b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects or will so pass upon final payment.
 - d. a list of all disputes that Contractor believes are unsettled; and
 - e. a Contractor's Waiver and Release Agreement for itself as of the date of Final Application for Payment and Subcontractors-Suppliers Waiver and Release Agreements for each of its Subcontractors and Suppliers as of the date of the Final Application for Payment.
 - 3. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.
 - 4. If Contractor is required to pay prevailing wages, prior to final payment and in accordance with ORC 4115.05, Contractor and its Subcontractors shall each file with Owner an affidavit certifying their compliance with ORC 4115.03 to ORC 4115.16 regarding wages.
- B. Engineer's Review of Application and Acceptance:
- 1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.
- C. Completion of Work: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.
- D. Payment Becomes Due: Thirty (30) days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 Waiver of Claims

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from

defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.

- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 Correction Period

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. correct the defective repairs to the Site or such other adjacent areas;
 - 2. correct such defective Work;
 - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, 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 such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).
- C. In special circumstances where an item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or limitation upon, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 Owner May Suspend Work

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than ninety (90) consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than thirty (30) days after the date fixed for resumption of Work.

16.02 Owner May Terminate for Cause

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
 - 1. Contractor's failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply enough skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);
 - 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
 - 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 - 4. Contractor's disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) three business days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:
 - 1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and
 - 2. enforce the rights available to Owner under any applicable performance bond.
 - 3. Such termination shall be effective as of the date stated in the termination notice provided to Contractor.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within three business days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other

professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

16.03 Owner May Terminate for Convenience

- A. Upon three business days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. Such termination shall be effective as of the date stated in the written notice. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including compensation as set forth in the schedule of values or Bid Form in the case of unit prices;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid because of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.
- C. Contractor shall require similar provisions contained in Paragraph 16.03 in each of its subcontracts to protect Contractor from claims by Subcontractors arising from the Owner's termination for convenience, or to minimize claims by such subcontractors. The remedy provided to Contractor under this Paragraph 16.03 shall be the Contractor's sole remedy in the event of termination for convenience by Owner.

16.04 Contractor May Stop Work or Terminate

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than ninety (90) consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within thirty (30) days after it is submitted, or (3) Owner fails for sixty (60) days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within thirty (30) days after it is submitted, or Owner has failed for sixty (60) days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 Methods and Procedures

- A. Litigation, Settlement, Methods, and Procedures.
 - 1. Any dispute, claim, or other matter not settled by negotiation, shall be determined by the Court of Common Pleas for Montgomery County, Ohio, which shall be exclusive venue and jurisdiction over such matters and claims, to the exclusion of any other court, including any U.S. District Court.

ARTICLE 18 – MISCELLANEOUS

18.01 Giving Notice

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
 - 1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or
 - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 Computation of Times

- A. When any period of time is referred to in the Contract by days, it will 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 or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 Cumulative Remedies

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each duty, obligation, right, and remedy to which they apply.

18.04 Limitation of Damages

- A. With respect to all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 No Waiver

- A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 Survival of Obligations

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 Controlling Law

- A. This Contract is to be governed by the law of the State of Ohio.

18.08 Headings

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

18.09 Equal Employment Opportunity and Non-Discrimination.

- A. The Contractor shall comply with and shall require all Subcontractors of any tier to comply with, the applicable equal employment opportunity and non-discrimination statute and regulations of the State of Ohio.

18.10 Severability

- A. If any provision of this Agreement is held invalid, illegal or unenforceable in any respect, the remainder of the terms, provisions, covenants and restrictions set forth in this Agreement shall in no way be affected, impaired or invalidated. With respect to any invalidated provision of this Agreement, the parties shall negotiate and in good faith agree to such amendments, modifications or supplements to this Agreement, and shall, to the maximum extent practicable, implement and give effect to the intentions of the parties in this Agreement.

18.11 Assignment

- A. No assignment of this Agreement by Contractor is permitted or authorized without the express written consent of Owner.

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SECTION 00800

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions (Modified EJCDC 2013 Edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

TABLE OF ARTICLES

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS;
HAZARDOUS ENVIRONMENTAL CONDITIONS

ARTICLE 6 – BONDS AND INSURANCE

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

SC-1.01 *Defined Terms*

Add to the list of definitions in Paragraph 1.01.A by inserting the following as numbered items in their proper alphabetical positions:

1. *Water Reclamation Manger – The person employed by the Owner to operate, supervise and otherwise control the existing water reclamation facilities.*

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

SC-5.03 *Subsurface and Physical Conditions*

If there are no known Site-related reports or drawings used in the design of the project, delete Paragraphs 5.03.A and 5.03.B in their entirety and insert the following version:

- A. No reports of exploration or tests of subsurface conditions at or adjacent to the Site, or drawings of physical conditions relating to existing surface or subsurface structures at the Site, are known to the Owner.

ARTICLE 6 – BONDS AND INSURANCE

SC-6.03 *Contractor's Insurance:*

Add the following new paragraphs immediately after Paragraph 6.03.A.4 of the General Conditions, which is to read as follows:

2. *Policy shall contain a waiver of subrogation in favor of The Board of County Commissioners of Montgomery County, Ohio, and Montgomery County Environmental Services.*
3. *Contractor's subcontractor(s) shall be subject to the same minimum requirements identified in this section.*

Replace Paragraph 6.03.C.7 with the following:

4. *Additional insured forms should be CG 20 10 11 85 or CG 20 10 10 01 or 04 13 and CG 20 37 07 04 or an equivalent.*

Add the following new paragraphs immediately after Paragraph 6.03.C.9 of the General Conditions, which is to read as follows:

5. *The policy shall be endorsed to include the following additional insured language: "The Board of County Commissioners, Montgomery County, Ohio, Montgomery County Environmental Services, and SPGB Architects, LLC shall be named as an additional insured with respect to liability arising out of the activities performed by, or on behalf of the Contractor, including completed operations."*
6. *Coverage shall be primary and non-contributory. Associated bid number, job number, or project number should be referenced on the certificate.*
7. *The policy should contain an unintentional failure to disclose endorsement.*

8. *Policy should be endorsed with Notice of Occurrence-CEO, President, CFO, Risk Manager or General Counsel wording.*
9. *Associated bid number, job number, or project number should be referenced on the certificate of insurance.*
10. *General liability should be aggregate per location if construction activities are involved.*
11. *Contractor's subcontractor shall be subject to the same minimum requirements identified above.*

Add the following new paragraphs immediately after Paragraph 6.03.D of the General Conditions, which is to read as follows:

12. *The policy shall be endorsed to include the following additional insured language: "The Board of County Commissioners of Montgomery County, Ohio, Montgomery County Environmental Services, and SPGB Architects, LLC shall be named as an additional insured with respect to liability arising out of the activities performed by or on behalf of the Contractor, including automobiles owned, leased, hired, or borrowed by the Contractor."*
13. *Coverage shall be primary and non-contributory.*
14. *Contractor's subcontractor shall be subject to the same minimum requirements identified above.*
15. *Associated bid number, job number, or project number should be referenced on the certificate.*
16. *The policy should include a notice of occurrence endorsement – CEO, President, CFO, Risk Manager, or General Counsel.*

Add the following new paragraphs immediately after Paragraph 6.03.E of the General Conditions, which is to read as follows:

17. *The policy shall be endorsed to include the following additional insured language: "The Board of County Commissioners of Montgomery County, Ohio, Montgomery County Environmental Services, and SPGB Architects, LLC shall be named as an additional insured with respect to liability arising out of the activities performed by or on behalf of the Contractor, including automobiles owned, leased, hired, or borrowed by the Contractor."*

Add the following new paragraphs immediately after Paragraph 6.03.I.2 of the General Conditions, which is to read as follows:

- a. Contractor's Commercial General Liability Insurance. For the Commercial General Liability Insurance required under Article 6 of the General Conditions, Contractor shall provide coverage with limits of liability not less than those stated below:

For Projects less than \$10,000,000

General Aggregate	\$2,000,000
Products Completed Operations	\$1,000,000

Personal and Advertising Injury	\$1,000,000
Each Occurrence	\$1,000,000
For Projects from \$10,000,000 to \$29,999,999.99	
General Aggregate	\$3,000,000
Products Completed Operations	\$3,000,000
Personal and Advertising Injury	\$3,000,000
Each Occurrence	\$3,000,000
For Projects from \$30,000,000 to \$49,999,999	
General Aggregate	\$5,000,000
Products Completed Operations	\$5,000,000
Personal and Advertising Injury	\$5,000,000
Each Occurrence	\$5,000,000
For Projects from \$50,000,000 to \$100,000,000	
General Aggregate	\$7,000,000
Products Completed Operations	\$7,000,000
Personal and Advertising Injury	\$7,000,000
Each Occurrence	\$7,000,000
b. Automobile Liability.	
Combined Single Limit of	\$1,000,000
c. Workers' Compensation and Employers' Liability Insurance:	
1) State:	Statutory
2) Applicable Federal (e.g., Longshoreman's):	Statutory
3) Employer's Liability: Contractor shall maintain Workers' Compensation and Employer's Liability Insurance. Employers' Liability Insurance Limits shall not be less than:	
Each Accident	\$1,000,000
Disease – Each Employee	\$1,000,000
Disease – Policy Limit	\$1,000,000

SC-6.04 Property Insurance:

Replace Paragraph 6.04.A.1 with the following:

18. *include the Board of County Commissioners of Montgomery County, Ohio, Montgomery County Environmental Services, SPGB Architects, LLC, Contractor, and all Subcontractors, and any individuals or entities required by the Contract Documents to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.04, Paragraphs 6.05 and 6.06, and any corresponding sections in the Contract Documents, the parties required to be insured shall collectively be referred to as "insureds."*

Add the following to the end of Paragraph 6.04.A.7:

Policy shall be endorsed such that the insurance shall not be canceled or lapse because of any partial use or occupancy by the County.

Replace Paragraph 6.04.A.8 with the following:

19. *contain a waiver of subrogation in favor of The Board of County Commissioners of Montgomery County, Ohio.*

Replace Paragraph 6.04.A.13 with the following:

20. *be maintained until whichever of the following shall first occur: (1) final payment has been made; or, (2) until no person or entity, other than the Board of County Commissioners of Montgomery County, Ohio, has an insurable interest in the property required to be covered.*

Add the following new paragraphs immediately after paragraph 6.04.A.13 of the General Conditions which is to read as follows:

21. *include testing coverage that may be required.*
22. *require Contractor's subcontractor to be subject to the same minimum requirements identified in this section.*

Replace Paragraph 6.04.D with the following:

- D. *Notice of Cancellation or Change:* All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.04 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured. Policy must provide coverage from the time any covered property becomes the responsibility of the Contractor, and continue without interruption during construction, renovation, or installation, including any time during which the covered property is being transported to the construction installation site, or awaiting installation, whether on or off site.

SC-6.07 Additional Insurance Requirements

Add the following new paragraphs immediately after paragraph 6.06.C of the General Conditions which is to read as follows:

- A. *Additional Insurance Requirements:* On insurance policies where the Board of County Commissioners of Montgomery County, Ohio, Montgomery County Environmental Services, and SPGB Architects, LLC, are named as an additional insured, the Board of County Commissioners of Montgomery County, Ohio, Montgomery County Environmental Services,

and SPGB Architects, LLC shall be an additional insured to the full limits of liability purchased by the Contractor even if those limits of liability are in excess of those required by this Contract.

- B. The Contractor's insurance coverage shall be primary insurance and non-contributory with respect to all other available sources.
 - C. *Notice of Cancellation:* Each insurance policy required by the insurance provisions of this Contract shall provide the required coverage and shall not be suspended, voided, or canceled except after sixty (60) days prior written notice has been given to the County, except when cancellation is for non-payment of premium, then ten (10) days prior notice may be given. Such notice shall be sent directly to Montgomery County Environmental Services, 1850 Spaulding Road, Kettering, Ohio 45432, Attn: Rayshawn Bailey.
 - D. *Acceptability of Insurers:* Insurance is to be placed with insurers duly licensed or authorized to do business with the Board of County Commissioners of Montgomery County, Ohio, Montgomery County Environmental Services, and SPGB Architects, LLC with an "A.M. Best" rating of not less than A-IX. The County in no way warrants that the above-required minimum insurer rating is sufficient to protect the Contractor from potential insurer insolvency.
 - E. *Verification of Coverage:* Contractor shall furnish the County with three (3) certificates of insurance (ACORD form or equivalent approved by the County) as required by this Contract. The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf or, whenever specifically requested the County, three (3) certified copies of the insurance policies themselves and a receipt of evidence of full payment of the premiums.
23. *All certificates and any required endorsements are to be received and approved by the County before work commences. Each insurance policy required by this Contract must be in effect at or prior to commencement of work under this Contract and remain in effect for the duration of the project. Failure to maintain the insurance policies as required by this Contract or to provide evidence of renewal is a material breach of contract.*
24. *All certificates required by this Contract shall be sent directly to Montgomery County Environmental Services, 1850 Spaulding Road, Kettering, Ohio 45432, Attn: [Project Manager's Name]. The County project/contract number and project description shall be noted on the certificate of insurance. The County reserves the right to require complete, certified copies of all insurance policies required by this Contract at any time. DO NOT SEND CERTIFICATES OF INSURANCE TO THE COUNTY'S RISK MANAGEMENT DEPARTMENT.*
- F. *Subcontractors:* Contractors' certificate(s) shall include all subcontractors as additional insureds under its policies or subcontractors shall maintain separate insurance as determined by the Contractor, however, subcontractor's limits of liability shall not be less than \$1,000,000 per occurrence / \$2,000,000 aggregate.
 - G. *Approval:* Any modification or variation from the insurance requirements in this Contract shall be made by the Montgomery County Risk Management Department or the Montgomery County Prosecutor's Office, whose decision shall be final. Such action will not require a formal Contract amendment but may be made by administrative action.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

SC-7.06 Concerning Subcontractors, Suppliers and Others:

Add the following new paragraph immediately after Paragraph 7.06.O.2 of the General Conditions, which is to read as follows:

- P. Within five (5) days after Bid opening, each apparent Successful Bidder shall submit a list of all major Subcontractors and Suppliers for portions of the Work exceeding \$1,000. The list shall be accompanied by an experience statement and other evidence of qualification to perform the Work, a description of the Work to be performed and the approximate dollar amount of the Work for each listed Subcontractor or Supplier.

SC-7.10 Laws and Regulations:

Add the following new paragraphs immediately after Paragraph 7.10.D of the General Conditions, which is to read as follows:

- E. The Contractor, at its sole cost, agrees to comply with all applicable federal, state, and local laws in the conduct of work hereunder. The Contractor accepts full responsibility for payment of all unemployment compensation insurance premiums, workers' compensation premiums, benefits as mandated by the Patient Protection and Affordable Care Act (PPACA), all income tax deductions, pension deductions, prevailing wages, if applicable, and any and all other taxes or payroll deductions required for the Contractor and all employees engaged by the Contractor for the performance of the work authorized by this Agreement. The costs of any health insurance benefits required by the PPACA shall be the responsibility of the Contractor and shall not be billed directly to the Owner. The Contractor shall comply with the requirements of the PPACA and any and all associated costs and/or penalties. It shall be the responsibility of the Contractor to report, track and determine employee hours that are eligible to be offered insurance benefits.

- F. Submit all required Prevailing Wage reports to:

Montgomery County Environmental Services
1850 Spaulding Road
Kettering, Ohio 45432
Attn: Rayshawn Bailey

END OF SECTION

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PREVAILING RATES OF WAGE

6/1/2025

[illegible]

No special calculations for this skilled craft wage rate are required at this time.

1 Journeyman to 1 Apprentice 2-6 Journeyman to 2 Apprentice 7-11 Journeyman to 2 Apprentice 12-16 Journeyman to 3 Apprentice Mason Trainee Ratio 1 Apprentice permits 1 Mason Trainee 2 Apprentice permits 1 Mason Trainee 3 Apprentice permits 2 Mason Trainee 4 Apprentice permits 2 Mason Trainee

Fayette, Pike, Ross, Vinton, Jackson

Mason Trainee work on a job site unless a registered apprentice is on the job and the ratios in table above will be strictly enforced. ***BAT registered apprentice must be employed prior to hiring mason trainee (s). A mason trainee MAY NOT work on a jobsite unless a registered apprentice is on the job.***

Type of Rate: Commercial

LCN01-2024ib

Bricklayer

5/1/2024

5/1/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Bricklayer Marble, Terrazzo, Mosaic	\$37.96		\$11.40	\$9.45	\$0.78	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$59.59	\$78.57
Swing Scaffold Workers	\$38.96		\$11.40	\$9.45	\$0.78	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$60.59	\$80.07
Stack	\$38.46		\$11.40	\$9.45	\$0.78	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$60.09	\$79.32
Masonry Maintenance	\$17.08		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$17.08	\$25.62
Apprentice	BHR	Percent										
1st 6 months	\$22.78	\$60.00	\$11.40	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$34.18	\$45.56
2nd 6 months	\$24.67	\$65.00	\$11.40	\$9.45	\$0.78	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$46.30	\$58.64

3rd months	6	\$26.57	\$70.00	\$11.40	\$9.45	\$0.78	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$48.20	\$61.49
4th months	6	\$28.47	\$75.00	\$11.40	\$9.45	\$0.78	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$50.10	\$64.34
5th months	6	\$30.37	\$80.00	\$11.40	\$9.45	\$0.78	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$52.00	\$67.18
6th months	6	\$32.27	\$85.02	\$11.40	\$9.45	\$0.78	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$53.90	\$70.04
7th months	6	\$34.16	\$90.00	\$11.40	\$9.45	\$0.78	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$55.79	\$72.88
8th months	6	\$36.06	\$95.00	\$11.40	\$9.45	\$0.78	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$57.69	\$75.72
MASON TRAINEE S 1st 90 Days		\$17.08	\$45.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$17.08	\$25.62
1st Year after 90 Days		\$17.08	\$45.00	\$11.40	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$28.48	\$37.02
2nd Year		\$18.98	\$50.00	\$11.40	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$30.38	\$39.87

(*)Special Calculation Note :

Classification title contains "Bricklayer" because contract originates within the Bricklayer Local.

Ratio :

1-2 Journeyman to 1 Apprentice 3-4 Journeyman to 2 Apprentices 5-6 Journeyman to 3 Apprentices 7-10 Journeyman to 4 Apprentices 1 Apprentice permits 1 Mason Trainee 2 Apprentice permits 1 Mason Trainee 3 Apprentice permits 2 Mason Trainee 4 Apprentice permits 2 Mason Trainee

Jurisdiction (* denotes special jurisdictional note) :

Ashtabula, Geauga, Lake, Portage, Summit

Special Jurisdictional Note :

Details :

In the mutual interest of both Employer and Union and to promote the masonry industry, it is agreed that the Employer may work with the Union and the Local Educational Partners in the jurisdiction of this agreement to employ School to work students provided that no conflicts exist with any Federal or State Laws. Employer must be party to a bonified Apprenticeship and Training program registered with the State of Ohio (OSAC). It is further agreed by both parties that the wages for the Masonry Maintenance Specialist shall be forty-five percent (45%) of the journeyman rate with no fringe benefits or as specified by the Local Educational Partner in the jurisdiction of the agreement.

Prevailing Wage Rate Skilled Crafts

Name of Union: Bricklayer Local 23 (Columbus)

Type of Rate: Commercial

Change #:

LCN01-2025ib

Craft:

Bricklayer

Effective Date:

6/1/2025

Effective Date:

6/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Bricklayer	\$37.35		\$10.48	\$9.04	\$0.74	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$58.86	\$77.54
Lay Out Man	\$37.85		\$10.48	\$9.04	\$0.74	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$59.36	\$78.29
Saw Man	\$37.85		\$10.48	\$9.04	\$0.74	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$59.36	\$78.29
Stone & Cement Mason	\$37.35		\$10.48	\$9.04	\$0.74	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$58.86	\$77.54
Pointer Caulker Cleaner Block Stone	\$37.35		\$10.48	\$9.04	\$0.74	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$58.86	\$77.54
Plaster	\$37.35		\$10.48	\$9.04	\$0.74	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$58.86	\$77.54
Swing Stage (Ground Floors thru 23 Floors)	\$38.35		\$10.48	\$9.04	\$0.74	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$59.86	\$79.04
Swing Stage (24th Floors and Above)	\$39.35		\$10.48	\$9.04	\$0.74	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$60.86	\$80.54
Apprentice	BHR	Percent										
1st Year	\$26.15	\$70.00	\$10.48	\$9.04	\$0.74	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$47.66	\$60.73
2nd Year	\$29.88	\$80.00	\$10.48	\$9.04	\$0.74	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$51.39	\$66.33
3rd Year	\$33.62	\$90.00	\$10.48	\$9.04	\$0.74	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$55.13	\$71.93
4th Year	\$35.48	\$95.00	\$10.48	\$9.04	\$0.74	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$56.99	\$74.73
MASON TRAINEES	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
1-90 Days	\$18.68	\$50.02	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$18.68	\$28.02
90-365 Days	\$18.68	\$50.02	\$10.48	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$29.16	\$38.50
2nd Year	\$20.54	\$55.00	\$10.48	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$31.02	\$41.29

(*)Special Calculation Note :

No special calculations for this skilled craft wage rate are required at this time.

Ratio :

REQUIRED RATIO 1-2 Journeyman to 1 Apprentice 3- 6 Journeyman to 2 Apprentice 7-10 Journeyman to 3 Apprentice 1-15 Journeyman to 4 Apprentice MASON TRAINEE REQUIRED RATIO 1 Apprentice permits 1 Mason Trainee 2 Apprentice permits 1 Mason Trainee 3 Apprentice permits 2 Mason Trainee 4 Apprentice permits 2 Mason Trainee

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Franklin, Madison, Pickaway, Union

Special Jurisdictional Note :**Details :**

MASON TRAINEE: duties shall be to work in all aspects of Masonry construction taking direction from the employer and the Journeyman Bricklayer & Stone Mason's working on the job. MASON TRAINEE may work on job site only when a registered apprentice is on job and the ratios in above table will be strictly enforced. Above Journeyman Rate: Brick Power Saw Pay \$.50 Designated layout person \$.50 Swingstage Work \$1.00 at start, and additional \$2.00 at 24th floor

Prevailing Wage Rate Skilled Crafts**Name of Union:** Bricklayer Local 23 (East Liverpool Industrial)**Type of Rate:** Commercial**Change #:**

LCN01-2023ib

Craft:

Bricklayer

Effective Date:

7/5/2023

Effective Date:

7/5/2023

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Bricklayer	\$35.59		\$9.40	\$6.04	\$0.96	\$0.00	\$5.60	\$0.00	\$0.00	\$0.00	\$57.59	\$75.39
Plaster	\$35.59		\$9.40	\$6.04	\$0.96	\$0.00	\$5.60	\$0.00	\$0.00	\$0.00	\$57.59	\$75.39
Stone Marble Cement Mason	\$35.59		\$9.40	\$6.04	\$0.96	\$0.00	\$5.60	\$0.00	\$0.00	\$0.00	\$57.59	\$75.39
Pointer Caulker Cleaner	\$35.59		\$9.40	\$6.04	\$0.96	\$0.00	\$5.60	\$0.00	\$0.00	\$0.00	\$57.59	\$75.39
Saw Man	\$36.09		\$9.40	\$6.04	\$0.96	\$0.00	\$5.60	\$0.00	\$0.00	\$0.00	\$58.09	\$76.14
Apprentice	BHR	Percent										
1st 6 months	\$21.35	\$60.00	\$9.40	\$6.04	\$0.96	\$0.00	\$5.60	\$0.00	\$0.00	\$0.00	\$43.35	\$54.03
2nd 6 months	\$23.13	\$65.00	\$9.40	\$6.04	\$0.96	\$0.00	\$5.60	\$0.00	\$0.00	\$0.00	\$45.13	\$56.70
3rd 6 months	\$24.91	\$70.00	\$9.40	\$6.04	\$0.96	\$0.00	\$5.60	\$0.00	\$0.00	\$0.00	\$46.91	\$59.37
4th 6 months	\$26.69	\$75.00	\$9.40	\$6.04	\$0.96	\$0.00	\$5.60	\$0.00	\$0.00	\$0.00	\$48.69	\$62.04
5th 6 months	\$28.47	\$80.00	\$9.40	\$6.04	\$0.96	\$0.00	\$5.60	\$0.00	\$0.00	\$0.00	\$50.47	\$64.71
6th 6 months	\$30.25	\$85.00	\$9.40	\$6.04	\$0.96	\$0.00	\$5.60	\$0.00	\$0.00	\$0.00	\$52.25	\$67.38

7th months	6	\$32.03	\$90.00	\$9.40	\$6.04	\$0.96	\$0.00	\$5.60	\$0.00	\$0.00	\$0.00	\$54.03	\$70.05
8th months	6	\$33.81	\$95.00	\$9.40	\$6.04	\$0.96	\$0.00	\$5.60	\$0.00	\$0.00	\$0.00	\$55.81	\$72.72

(*)Special Calculation Note :
 No special calculations for this skilled craft wage rate are required at this time.

Ratio :
 1 - 4 Journeymen to 1 Apprentice 5 - 8 Journeymen to 2 Apprentice 9 - 12 Journeymen to 3 Apprentice 13 - 16 Journeymen to 4 Apprentice 1 Apprentice permits 1 Trainee 2 Apprentice permits 1 Trainee 3 Apprentice permits 2 Trainees 4 Apprentice permits 2 Trainees

Jurisdiction (* denotes special jurisdictional note) :
 Columbiana*, Harrison, Jefferson*

Special Jurisdictional Note :
 Jefferson County included except Warren and Mt. Pleasant Townships and the Dillonvale.

Details :

Prevailing Wage Rate Skilled Crafts
Name of Union: Bricklayer Local 23 (Fremont)
Type of Rate: Commercial

Change #:
 LCN01-2025ib

Craft:
 Bricklayer

Effective Date:
 6/1/2025

Effective Date:
 6/1/2025

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Bricklayer	\$38.17	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$63.41	\$82.50
Stone Mason	\$38.17	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$63.41	\$82.50
Pointer Caulker Cleaner	\$38.17	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$63.41	\$82.50
Layout Man	\$38.17	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$63.41	\$82.50
Saw Man	\$38.17	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$63.41	\$82.50
Stack Worker	\$39.67	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$64.91	\$84.75
Carbon Masonry and Swing Sand Blasting	\$39.67	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$64.91	\$84.75

Refractory Hot Work	\$40.67		\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$65.91	\$86.25
Masonry Maintenance Specialist	\$19.09		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$19.09	\$28.64
Apprentice	BHR	Percent										
1st 6 Months	\$22.90	\$60.00	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$48.14	\$59.59
2nd 6 Months	\$24.81	\$65.00	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$50.05	\$62.46
3rd 6 Months	\$26.72	\$70.00	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$51.96	\$65.32
4th 6 Months	\$28.63	\$75.00	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$53.87	\$68.18
5th 6 Months	\$30.54	\$80.00	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$55.78	\$71.04
6th 6 Months	\$32.44	\$85.00	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$57.68	\$73.91
7th 6 Months	\$34.35	\$90.00	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$59.59	\$76.77
8th 6 Months	\$36.26	\$95.00	\$10.50	\$11.90	\$0.84	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$61.50	\$79.63
MASON TRAINEE S 1-90 Days	\$22.90	\$60.00	\$0.00	\$0.00	\$0.00	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$24.90	\$36.35
91-365 Days	\$22.90	\$60.00	\$10.50	\$0.00	\$0.00	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$35.40	\$46.85
2nd Year	\$26.72	\$70.00	\$10.50	\$0.00	\$0.00	\$0.00	\$2.00	\$0.00	\$0.00	\$0.00	\$39.22	\$52.58

(*)Special Calculation Note :

No special calculations for this skilled craft wage rate are required at this time.

Ratio :

1-2 Journeyman to 1 Apprentice 3-4 Journeyman to 2 Apprentice 5-6 Journeyman to 2 Apprentice 6-10 Journeyman to 3 Apprentice Apprentices must be hired prior to hiring Mason Trainees Mason Trainee Ratio 1 Apprentice permits 1 Mason Trainee 2 Apprentice permits 1 Mason Trainee 3 Apprentice permits 2 Mason Trainee 4 Apprentice permits 2 Mason Trainee

Jurisdiction (* denotes special jurisdictional note) :

Erie, Hancock, Huron, Ottawa, Sandusky*, Seneca, Wood*

Special Jurisdictional Note :

The Islands of Lake Erie north of Sandusky and the Townships of Perry and Bloom in Wood County.

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Carpenter Floorlayer Zone I South

Type of Rate: Commercial

Change #:

LCN01-2025ib

Craft:

Carpenter

Effective Date:

5/1/2025

Effective Date:

5/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Carpenter Floorlayer	\$30.92		\$8.89	\$11.48	\$0.89	\$0.00	\$4.99	\$0.00	\$0.00	\$0.00	\$57.17	\$72.63
Apprentice	BHR	Percent										
1st 3 Month Period	\$18.55	\$60.00	\$8.89	\$0.00	\$0.89	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$28.33	\$37.61
2nd 3 Month Period	\$18.55	\$60.00	\$8.89	\$0.00	\$0.89	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$28.33	\$37.61
2rd 6 Month Period	\$18.55	\$60.00	\$8.89	\$11.48	\$0.89	\$0.00	\$4.99	\$0.00	\$0.00	\$0.00	\$44.80	\$54.08
3rd 6 Month Period	\$20.10	\$65.00	\$8.89	\$11.48	\$0.89	\$0.00	\$4.99	\$0.00	\$0.00	\$0.00	\$46.35	\$56.40
4th 6 Month Period	\$23.19	\$75.00	\$8.89	\$11.48	\$0.89	\$0.00	\$4.99	\$0.00	\$0.00	\$0.00	\$49.44	\$61.04
5th 6 Month Period	\$24.74	\$80.00	\$8.89	\$11.48	\$0.89	\$0.00	\$4.99	\$0.00	\$0.00	\$0.00	\$50.99	\$63.35
6th 6 Month Period	\$26.28	\$85.00	\$8.89	\$11.48	\$0.89	\$0.00	\$4.99	\$0.00	\$0.00	\$0.00	\$52.53	\$65.67
7th 6 Month Period	\$27.83	\$90.00	\$8.89	\$11.48	\$0.89	\$0.00	\$4.99	\$0.00	\$0.00	\$0.00	\$54.08	\$67.99
8th 6 Month Period	\$29.37	\$95.00	\$8.89	\$11.48	\$0.89	\$0.00	\$4.99	\$0.00	\$0.00	\$0.00	\$55.62	\$70.31

(*)Special Calculation Note :

No special calculations for this skilled craft wage rate are required at this time.

Ratio :

1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Defiance, Henry, Ottawa, Williams

Special Jurisdictional Note :**Details :**

Prevailing Wage Rate Skilled Crafts
Name of Union: Carpenter Insulation Zone NEO 3
Type of Rate: Commercial

Change #:
LCN01-2025ib

Craft:
Carpenter

Effective Date:
6/18/2025

Effective Date:
6/18/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Carpenter Insulation	\$26.23		\$8.98	\$10.68	\$0.72	\$0.00	\$4.05	\$0.45	\$0.00	\$0.00	\$51.11	\$64.23
Apprentice	BHR	Percent										
1st months	3	\$15.74 \$60.00	\$8.98	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$24.72	\$32.59
2nd months	3	\$15.74 \$60.00	\$8.98	\$0.00	\$0.72	\$0.00	\$4.05	\$0.45	\$0.00	\$0.00	\$29.94	\$37.81
2nd months	6	\$17.05 \$65.00	\$8.98	\$0.00	\$0.72	\$0.00	\$4.05	\$0.45	\$0.00	\$0.00	\$31.25	\$39.77
3rd months	6	\$18.36 \$70.00	\$8.98	\$0.00	\$0.72	\$0.00	\$4.05	\$0.45	\$0.00	\$0.00	\$32.56	\$41.74
4th months	6	\$19.68 \$75.02	\$8.98	\$0.00	\$0.72	\$0.00	\$4.05	\$0.45	\$0.00	\$0.00	\$33.88	\$43.72
5th months	6	\$20.98 \$80.00	\$8.98	\$8.54	\$0.72	\$0.00	\$4.05	\$0.45	\$0.00	\$0.00	\$43.72	\$54.22
6th months	6	\$22.30 \$85.00	\$8.98	\$9.08	\$0.72	\$0.00	\$4.05	\$0.45	\$0.00	\$0.00	\$45.58	\$56.72
7th months	6	\$23.61 \$90.00	\$8.98	\$9.61	\$0.72	\$0.00	\$4.05	\$0.45	\$0.00	\$0.00	\$47.42	\$59.22
8th months	6	\$24.92 \$95.00	\$8.98	\$10.15	\$0.72	\$0.00	\$4.05	\$0.45	\$0.00	\$0.00	\$49.27	\$61.73

(*)Special Calculation Note :
OTHER IS :SUPPLEMENTAL UNEMPLOYMENT BENEFITS and Training

Ratio :
1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :
Mahoning, Trumbull

Special Jurisdictional Note :

Details :

Rates are for Commercial, Industrial & Road

Prevailing Wage Rate Skilled Crafts

Name of Union: Carpenter Millwright & Pile Driver Zone I South

Type of Rate: Commercial

Change #:

LCN01-2025ib

Craft:

Carpenter

Effective Date:

5/1/2025

Effective Date:

5/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Carpenter Millwright Pile Driver	\$38.02		\$8.88	\$12.75	\$0.91	\$0.00	\$6.26	\$0.00	\$0.00	\$0.00	\$66.82	\$85.83
Apprentice	BHR	Percent										
1st months	6	\$22.81	\$60.00	\$8.88	\$0.00	\$0.91	\$0.00	\$0.00	\$0.00	\$0.00	\$32.60	\$44.01
2nd months	6	\$22.81	\$60.00	\$8.88	\$12.75	\$0.91	\$0.00	\$6.26	\$0.00	\$0.00	\$51.61	\$63.02
3rd months	6	\$26.61	\$70.00	\$8.88	\$12.75	\$0.91	\$0.00	\$6.26	\$0.00	\$0.00	\$55.41	\$68.72
4th months	6	\$28.52	\$75.00	\$8.88	\$12.75	\$0.91	\$0.00	\$6.26	\$0.00	\$0.00	\$57.32	\$71.57
5th months	6	\$30.42	\$80.00	\$8.88	\$12.75	\$0.91	\$0.00	\$6.26	\$0.00	\$0.00	\$59.22	\$74.42
6th months	6	\$32.32	\$85.00	\$8.88	\$12.75	\$0.91	\$0.00	\$6.26	\$0.00	\$0.00	\$61.12	\$77.28
7th months	6	\$34.22	\$90.00	\$8.88	\$12.75	\$0.91	\$0.00	\$6.26	\$0.00	\$0.00	\$63.02	\$80.13
8th months	6	\$36.12	\$95.00	\$8.88	\$12.75	\$0.91	\$0.00	\$6.26	\$0.00	\$0.00	\$64.92	\$82.98

(*)Special Calculation Note :

No special calculations for this skilled craft wage rate are required at this time.

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Crawford, Paulding, Sandusky, Seneca

Special Jurisdictional Note :

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Carpenter Millwright Local 1090 Columbus

Type of Rate: Commercial

Change #:

LCN01-2025ib

Craft:

Carpenter

Effective Date:

5/13/2025

Effective Date:

5/13/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overti me Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Carpente r Millwrig ht	\$35.59		\$8.85	\$10.99	\$0.70	\$0.00	\$7.20	\$0.16	\$0.00	\$0.00	\$63.49	\$81.29
Apprenti ce	BHR	Percent										
1st months	6	\$24.91	\$70.00	\$8.85	\$10.99	\$0.70	\$0.00	\$7.20	\$0.16	\$0.00	\$52.81	\$65.27
2nd months	6	\$24.91	\$70.00	\$8.85	\$10.99	\$0.70	\$0.00	\$7.20	\$0.16	\$0.00	\$52.81	\$65.27
3rd months	6	\$28.47	\$80.00	\$8.85	\$10.99	\$0.70	\$0.00	\$7.20	\$0.16	\$0.00	\$56.37	\$70.61
4th months	6	\$28.47	\$80.00	\$8.85	\$10.99	\$0.70	\$0.00	\$7.20	\$0.16	\$0.00	\$56.37	\$70.61
5th months	6	\$32.03	\$90.00	\$8.85	\$10.99	\$0.70	\$0.00	\$7.20	\$0.16	\$0.00	\$59.93	\$75.95
6th months	6	\$32.03	\$90.00	\$8.85	\$10.99	\$0.70	\$0.00	\$7.20	\$0.16	\$0.00	\$59.93	\$75.95
7th months	6	\$33.81	\$95.00	\$8.85	\$10.99	\$0.70	\$0.00	\$7.20	\$0.16	\$0.00	\$61.71	\$78.62
8th months	6	\$33.81	\$95.00	\$8.85	\$10.99	\$0.70	\$0.00	\$7.20	\$0.16	\$0.00	\$61.71	\$78.62

(*)Special Calculation Note :

Other is for UBC National Fund.

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Delaware, Fairfield, Franklin, Guernsey, Licking, Madison, Marion, Morgan, Muskingum, Noble, Perry, Pickaway, Union

Special Jurisdictional Note :

Details :

The term “Millwright and Machine Erectors” jurisdiction shall mean the unloading, hoisting, rigging, skidding, moving, dismantling, aligning, erecting, assembling, repairing, maintenance and adjusting of all structures, processing areas either under cover, underground or elsewhere, required to process material, handle, manufacture or service, be it powered or receiving power manually, by steam, gas, electricity, gasoline, diesel, nuclear, solar, water, air or chemically, and in industries such as and including, which are identified for the purpose of description, but not limited to, the following: woodworking plants; canning industries; steel mills; coffee roasting plants; paper and pulp; cellophane; stone crushing; gravel and sand washing and handling; refineries; grain storage and handling; asphalt plants; sewage disposal; water plants; laundries; bakeries; mixing plants; can, bottle and bag packing plants; textile mills; paint mills; breweries; milk processing plants; power plants; aluminum processing or manufacturing plants; and amusement and entertainment fields. The installation of mechanical equipment in atomic energy plants; installation of reactors in power plants; installation of control rods and equipment in reactors; and installation of mechanical equipment in rocket missile bases, launchers, launching gantry, floating bases, hydraulic escape doors and any and all component parts thereto, either assembled, semi-assembled or disassembled. The installation of, but not limited to, the following: setting-up of all engines, motors, generators, air compressors, fans, pumps, scales, hoppers, conveyors of all types, sizes and their supports; escalators; man lifts; moving sidewalks; hosts; dumb waiters; all types of feeding machinery; amusement devices; mechanical pin setters and spotters in bowling alleys; refrigeration equipment; and the installation of all types of equipment necessary and required to process material either in the manufacturing or servicing. The handling and installation of pulleys, gears, sheaves, fly wheels, air and vacuum drives, worm drives and gear drivers directly or indirectly coupled to motors, belts, chains, screws, legs, boots, guards, booth tanks, all bin valves, turn heads and indicators, shafting, bearings, cable sprockets cutting all key seats in new and old work, troughs, chippers, filters, calendars, rolls, winders, rewinders, slitters, cutters, wrapping machines, blowers, forging machines, rams, hydraulic or otherwise, planning, extruder, ball, dust collectors, equipment in meat packing plants, splicing or ropes and cables. The laying-out, fabrication and installation of protection equipment including machinery guards, making and setting of templates for machinery, fabrication of bolts, nuts, pans, dripping of holes for any equipment which the Millwrights install regardless of materials; all welding and burning regardless of type, fabrication of all lines, hose or tubing used in lubricating machinery installed by Millwrights; grinding, cleaning, servicing and any machine work necessary for any part of any equipment installed by the Millwrights; and the break-in and trail run of any equipment or machinery installed by the Millwrights. It is agreed the Millwrights shall use the layout tools and optic equipment necessary to perform their work.

Prevailing Wage Rate Skilled Crafts

Name of Union: Carpenter Millwright Local 1090 SC South Point District A

Type of Rate: Commercial

Change #:
LCN01-2024ib

Craft:
Carpenter

Effective Date:
6/12/2024

Effective Date:
6/12/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Carpenter or Millwright	\$37.78		\$8.37	\$13.59	\$0.88	\$0.00	\$4.87	\$0.28	\$0.00	\$0.00	\$65.77	\$84.66
Apprentice	BHR	Percent										
1st 6 months	\$22.67	\$60.00	\$8.37	\$13.59	\$0.88	\$0.00	\$4.87	\$0.28	\$0.00	\$0.00	\$50.66	\$61.99
2nd 6 months	\$24.56	\$65.02	\$8.37	\$13.59	\$0.88	\$0.00	\$4.87	\$0.28	\$0.00	\$0.00	\$52.55	\$64.84

3rd months	6	\$26.45	\$70.00	\$8.37	\$13.59	\$0.88	\$0.00	\$4.87	\$0.28	\$0.00	\$0.00	\$54.44	\$67.66
4th months	6	\$28.34	\$75.00	\$8.37	\$13.59	\$0.88	\$0.00	\$4.87	\$0.28	\$0.00	\$0.00	\$56.33	\$70.49
5th months	6	\$30.22	\$80.00	\$8.37	\$13.59	\$0.88	\$0.00	\$4.87	\$0.28	\$0.00	\$0.00	\$58.21	\$73.33
6th months	6	\$32.11	\$85.00	\$8.37	\$13.59	\$0.88	\$0.00	\$4.87	\$0.28	\$0.00	\$0.00	\$60.10	\$76.16
7th months	6	\$34.00	\$90.00	\$8.37	\$13.59	\$0.88	\$0.00	\$4.87	\$0.28	\$0.00	\$0.00	\$61.99	\$78.99
8th months	6	\$35.89	\$95.00	\$8.37	\$13.59	\$0.88	\$0.00	\$4.87	\$0.28	\$0.00	\$0.00	\$63.88	\$81.83

(*)Special Calculation Note :

Other is UBC National Fund.

Ratio :

3 Journeymen to 1 Apprentice If certain projects warrant a larger percentage of apprentices, it will be agreed to increase the ratio of apprentices to journeymen, but Not to exceed (1) Apprentice to (4) Journeymen.

Jurisdiction (* denotes special jurisdictional note) :

Adams, Fayette, Gallia, Highland, Hocking, Jackson, Lawrence, Meigs, Pike, Ross, Scioto, Vinton

Special Jurisdictional Note :

Details :

The term “Millwright and Machine Erectors” jurisdiction shall mean the unloading, hoisting, rigging, skidding, moving, dismantling, aligning, erecting, assembling, repairing, maintenance and adjusting of all structures, processing areas either under cover, underground or elsewhere, required to process material, handle, manufacture or service, be it powered or receiving power manually, by steam, gas, electricity, gasoline, diesel, nuclear, solar, water, air or chemically, and in industries such as and including, which are identified for the purpose of description, but not limited to, the following: woodworking plants; canning industries; steel mills; coffee roasting plants; paper and pulp; cellophane; stone crushing; gravel and sand washing and handling; refineries; grain storage and handling; asphalt plants; sewage disposal; water plants; laundries; bakeries; mixing plants; can, bottle and bag packing plants; textile mills; paint mills; breweries; milk processing plants; power plants; aluminum processing or manufacturing plants; and amusement and entertainment fields. The installation of mechanical equipment in atomic energy plants; installation of reactors in power plants; installation of control rods and equipment in reactors; and installation of mechanical equipment in rocket missile bases, launchers, launching gantry, floating bases, hydraulic escape doors and any and all component parts thereto, either assembled, semi-assembled or disassembled. The installation of, but not limited to, the following: setting-up of all engines, motors, generators, air compressors, fans, pumps, scales, hoppers, conveyors of all types, sizes and their supports; escalators; man lifts; moving sidewalks; hosts; dumb waiters; all types of feeding machinery; amusement devices; mechanical pin setters and spotters in bowling alleys; refrigeration equipment; and the installation of all types of equipment necessary and required to process material either in the manufacturing or servicing. The handling and installation of pulleys, gears, sheaves, fly wheels, air and vacuum drives, worm drives and gear drivers directly or indirectly coupled to motors, belts, chains, screws, legs, boots, guards, booth tanks, all bin valves, turn heads and indicators, shafting, bearings, cable sprockets cutting all key seats in new and old work, troughs, chippers, filters, calendars, rolls, winders, rewinders, slitters, cutters, wrapping machines, blowers, forging machines, rams, hydraulic or otherwise, planning, extruder, ball, dust collectors, equipment in meat packing plants, splicing or ropes and cables. The laying-out, fabrication and installation of protection equipment including machinery guards, making and setting of templates for machinery, fabrication of bolts, nuts, pans, dripping of holes for any equipment which the Millwrights install regardless of materials; all welding and burning regardless of type, fabrication of all lines, hose or tubing used in lubricating machinery installed by Millwrights; grinding, cleaning, servicing and any machine work necessary for any part of any equipment installed by the Millwrights; and the break-in and trail run of any equipment or machinery installed by the Millwrights. It is agreed the Millwrights shall use the layout tools and optic equipment necessary to perform their work.

Prevailing Wage Rate Skilled Crafts

Name of Union: Carpenter- Residential Zone I North

Type of Rate: Residential

Change #:

LCN01-2025ib

Craft:
Carpenter

Effective Date:
5/1/2025

Effective Date:
5/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Carpenter	\$35.40		\$8.85	\$4.27	\$0.86	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$50.63	\$68.33
Apprentice	BHR	Percent										
1st months	6	\$21.24 \$60.00	\$8.85	\$4.27	\$0.86	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$36.47	\$47.09
2nd months	6	\$21.24 \$60.00	\$8.85	\$4.27	\$0.86	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$36.47	\$47.09
3rd months	6	\$23.01 \$65.00	\$8.85	\$4.27	\$0.86	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$38.24	\$49.75
4th months	6	\$26.55 \$75.00	\$8.85	\$4.27	\$0.86	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$41.78	\$55.06
5th months	6	\$28.32 \$80.00	\$8.85	\$4.27	\$0.86	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$43.55	\$57.71
6th months	6	\$30.09 \$85.00	\$8.85	\$4.27	\$0.86	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$45.32	\$60.37
7th months	6	\$31.86 \$90.00	\$8.85	\$4.27	\$0.86	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$47.09	\$63.02
8th months	6	\$33.63 \$95.00	\$8.85	\$4.27	\$0.86	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$48.86	\$65.68

(*)Special Calculation Note :

No special calculations for this skilled craft wage rate are required at this time.

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Lucas, Wood

Special Jurisdictional Note :

Details :

Residential work is defined as work within the carpenter trade on structures designed for permanent habitation of including single family dwellings and multi-family dwellings such as apartments and condos. Traditional carpentry includes but not limited to: placing, setting and aligning concrete form systems: fabrication and installation of all framing components: installation and maintenance of shingle roof systems: installation of wall board systems, installation of all finish carpentry systems, installation of all exterior siding systems, and the placing, setting and aligning of all decks and decorative exterior systems, overhead doors, all type of wall and floorcovering.

Prevailing Wage Rate Skilled Crafts

Name of Union: Cement Mason Local 404 Hev Hwy

Type of Rate: Commercial

Change #:
LCN01-2025ib

Craft:
Cement Mason

Effective Date:
5/1/2025

Effective Date:
5/1/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overti me Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Cement Mason	\$36.29		\$9.20	\$7.85	\$0.75	\$0.00	\$3.00	\$0.07	\$0.00	\$0.00	\$57.16	\$75.31
Apprenti ce	BHR	Percent										
1st Year	\$25.40	\$70.00	\$9.20	\$7.85	\$0.75	\$0.00	\$3.00	\$0.07	\$0.00	\$0.00	\$46.27	\$58.97
2nd Year	\$29.03	\$80.00	\$9.20	\$7.85	\$0.75	\$0.00	\$3.00	\$0.07	\$0.00	\$0.00	\$49.90	\$64.42
3rd Year	\$32.66	\$90.00	\$9.20	\$7.85	\$0.75	\$0.00	\$3.00	\$0.07	\$0.00	\$0.00	\$53.53	\$69.86
4th Year	\$34.48	\$95.00	\$9.20	\$7.85	\$0.75	\$0.00	\$3.00	\$0.07	\$0.00	\$0.00	\$55.35	\$72.58

(*)Special Calculation Note :
Other: International Training Fund

Ratio :
1 Journeyman to 1 Apprentice 2 Journeymen to 1 Apprentice thereafter

Jurisdiction (* denotes special jurisdictional note) :
Ashtabula, Cuyahoga, Geauga, Lake, Lorain

Special Jurisdictional Note :

Details :
Highway Construction, Sewer, Waterworks And Utility Construction, Industrial & Building Site, Heavy Construction, Airport Construction Or Railroad Construction Work, Power Plant, Tunnels, Amusement Park, Athletic Stadium Site Work, Pollution Control, Sewer Plant, Waste & Water Plant, Water Treatment Facilities Construction.

Prevailing Wage Rate Skilled Crafts
Name of Union: Electrical Local 141 Voice Data Video
Type of Rate: Commercial

Change #:
LCN01-2025ib

Craft:
Electrical Voice Data Video

Effective Date:
6/4/2025

Effective Date:
6/4/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrical Installer Technician	\$27.35		\$10.25	\$8.00	\$0.31	\$6.80	\$0.00	\$0.82	\$0.00	\$0.90	\$54.43	\$68.11
Cable Puller	\$14.22		\$10.25	\$4.16	\$0.31	\$3.54	\$0.00	\$0.43	\$0.00	\$0.90	\$33.81	\$40.92
Apprentice	BHR	Percent										
1st 750 hrs	\$15.04	\$55.00	\$11.15	\$4.40	\$0.31	\$3.74	\$0.00	\$0.45	\$0.00	\$0.00	\$35.09	\$42.61
2nd 750 hrs	\$17.78	\$65.00	\$11.15	\$5.20	\$0.31	\$4.42	\$0.00	\$0.53	\$0.00	\$0.00	\$39.39	\$48.28
3rd 750 hrs	\$20.51	\$75.00	\$11.15	\$6.00	\$0.31	\$5.10	\$0.00	\$0.62	\$0.00	\$0.00	\$43.69	\$53.95
4th 750 hrs	\$21.88	\$80.00	\$11.15	\$6.40	\$0.31	\$5.44	\$0.00	\$0.66	\$0.00	\$0.00	\$45.84	\$56.78
5th 750 hrs	\$23.25	\$85.00	\$11.15	\$6.80	\$0.31	\$5.78	\$0.00	\$0.70	\$0.00	\$0.00	\$47.99	\$59.61
6th 750 hrs	\$24.62	\$90.00	\$11.15	\$7.20	\$0.31	\$6.12	\$0.00	\$0.74	\$0.00	\$0.00	\$50.14	\$62.44

(*)Special Calculation Note :

Ratio :
1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :
Belmont

Special Jurisdictional Note :

Details :

The following work is EXCLUDED from Teledata Technician work scope: The installation of computer systems in industrial applications such as assembly lines, robotics, computer controller manufacturing systems. The installation of conduit and/or raceways shall be installed by Inside Wireman. On sites where there is no Inside Wireman employed, the Teledata Technician may install raceway, or conduit not greater than 10 feet. Fire Alarm work is excluded on all new construction sites or wherever the fire alarm system is installed in conduit. All HVAC control work. Cable Pullers:are for the installation of cable from one termination point to another.

Prevailing Wage Rate Skilled Crafts
Name of Union: Electrical Local 540 Voice Data Video
Type of Rate: Commercial

Change #:
LCN01-2024ib

Craft:
Voice Data Video

Effective Date:
8/28/2024

Effective Date:

8/28/2024

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrical Installer Technician	\$26.72		\$6.95	\$4.94	\$0.66	\$2.67	\$2.06	\$0.88	\$0.00	\$0.00	\$44.88	\$58.24
Cable Puller	\$14.44		\$6.67	\$0.00	\$0.32	\$0.00	\$0.43	\$0.43	\$0.00	\$0.00	\$22.29	\$29.51
Apprentice	BHR	Percent										
1st Step	\$18.70	\$70.00	\$6.95	\$0.00	\$0.45	\$1.50	\$0.61	\$0.61	\$0.00	\$0.00	\$28.82	\$38.18
2nd Step	\$20.04	\$75.00	\$6.95	\$0.00	\$0.49	\$1.60	\$0.65	\$0.65	\$0.00	\$0.00	\$30.38	\$40.40
3rd Step	\$21.38	\$80.00	\$6.95	\$4.94	\$0.52	\$1.71	\$0.69	\$0.69	\$0.00	\$0.00	\$36.88	\$47.56
4th Step	\$22.71	\$85.00	\$6.95	\$4.94	\$0.55	\$1.82	\$0.74	\$0.74	\$0.00	\$0.00	\$38.45	\$49.81

(*)Special Calculation Note :

OTHER = (NEBF) National Electrical Benefit Fund. VACATION PAY - For Journeymen is 10% of wages and 8% for Apprentices.

Ratio :

1-3 Journeyman to 2 Apprentice 4-6 Journeyman to 4 Apprentice ** Exception - When fire alarm falls within the scope of this addendum, Cable Pullers can be used to aid in test and be the 2nd Teledata employee on the job

Jurisdiction (* denotes special jurisdictional note) :

Carroll*, Columbiana*, Holmes, Mahoning*, Stark, Tuscarawas*, Wayne*

Special Jurisdictional Note :

Carroll County includes the following townships: North half including Fox, Harrison, Rose and Washington. Columbiana County includes Knox township. Mahoning County includes Smith township. Tuscarawas County includes the following townships: The portion North of Auburn, Clay, Rush and York. Wayne County includes the following townships: The portion South of Baughman, Chester, Green, and Wayne.

Details :

CABLE PULLERS - are for the installation of cable from one termination point to another. The following work is EXCLUDED from the Teledata Technician work scope: * - Installation of computer systems in industrial applications such as assembly lines, robotics, computer controller manufacturing systems. * - Installation of conduit and/ or raceways shall be installed by Inside Wireman . On sites where there is no Inside Wireman employed, the Teledata Technician may install raceway, or conduit not greater than 10 feet. * - Fire Alarm work on all new construction sites or wherever the fire alarm system is installed in conduit. * - All HVAC control work.

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 648 Lt Commercial South West

Type of Rate: Residential

Change #:

LCN01-2013fb

Craft:

Electrical

Effective Date:

5/1/2013

Effective Date:

5/1/2013

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrician	\$26.50		\$4.90	\$6.30	\$0.40	\$0.00	\$0.50	\$0.00	\$0.00	\$0.00	\$38.60	\$51.85
Industrial jobs or Industrial projects fairly estimate d to be 25000 man hrs or more	\$29.44		\$4.90	\$6.30	\$0.44	\$0.00	\$0.50	\$0.00	\$0.00	\$0.00	\$41.58	\$56.30
Wireman at Miller Brewery	\$27.83		\$4.90	\$6.30	\$0.42	\$0.00	\$0.50	\$0.00	\$0.00	\$0.00	\$39.95	\$53.87
Construction Electrician 3	\$19.93		\$4.31	\$0.60	\$0.64	\$0.00	\$0.60	\$0.00	\$0.00	\$0.10	\$26.18	\$36.15
Construction Electrician 2	\$15.66		\$4.31	\$0.47	\$0.64	\$0.00	\$0.47	\$0.00	\$0.00	\$0.10	\$21.65	\$29.48
Construction Electrician 1	\$14.23		\$4.31	\$0.43	\$0.64	\$0.00	\$0.43	\$0.00	\$0.00	\$0.10	\$20.14	\$27.26
Construction Wireman 4	\$12.81		\$4.31	\$0.38	\$0.64	\$0.00	\$0.38	\$0.00	\$0.00	\$0.10	\$18.62	\$25.03
Construction Wireman 3	\$11.39		\$4.31	\$0.34	\$0.64	\$0.00	\$0.34	\$0.00	\$0.00	\$0.10	\$17.12	\$22.82
Construction Wireman 2	\$9.96		\$4.31	\$0.30	\$0.64	\$0.00	\$0.30	\$0.00	\$0.00	\$0.10	\$15.61	\$20.59
Construction Wireman 1	\$9.96		\$4.31	\$0.30	\$0.64	\$0.00	\$0.30	\$0.00	\$0.00	\$0.10	\$15.61	\$20.59
Apprentice	BHR	Percent										
1st period 0-1000 hrs	\$10.60	\$40.00	\$4.90	\$0.00	\$0.16	\$0.00	\$0.50	\$0.00	\$0.00	\$0.00	\$16.16	\$21.46
2nd period	\$11.93	\$45.00	\$4.90	\$0.00	\$0.18	\$0.00	\$0.50	\$0.00	\$0.00	\$0.00	\$17.51	\$23.47

1000-2000 hrs												
3rd period 2000-3500 hrs	\$13.25	\$50.00	\$4.90	\$6.30	\$0.20	\$0.00	\$0.50	\$0.00	\$0.00	\$0.00	\$25.15	\$31.78

4th period 3500-5000 hrs	\$14.58	\$55.00	\$4.90	\$6.30	\$0.22	\$0.00	\$0.50	\$0.00	\$0.00	\$0.00	\$26.50	\$33.78
5th period 5000-6500 hrs	\$15.90	\$60.00	\$4.90	\$6.30	\$0.24	\$0.00	\$0.50	\$0.00	\$0.00	\$0.00	\$27.84	\$35.79
6th period 6500-8000 hrs	\$19.35	\$73.02	\$4.90	\$6.30	\$0.29	\$0.00	\$0.50	\$0.00	\$0.00	\$0.00	\$31.34	\$41.02
Apprentice Indentured BEFORE 9/1/2006	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
3th period	\$13.10	\$49.45	\$4.50	\$4.30	\$0.20	\$0.00	\$0.50	\$0.00	\$0.00	\$0.00	\$22.60	\$29.16
4th period	\$14.41	\$54.38	\$4.50	\$4.30	\$0.22	\$0.00	\$0.50	\$0.00	\$0.00	\$0.00	\$23.93	\$31.14
5th period	\$17.64	\$66.55	\$4.70	\$5.90	\$0.26	\$0.00	\$0.50	\$0.00	\$0.00	\$0.00	\$29.00	\$37.81
6th period	\$20.64	\$78.00	\$4.80	\$6.00	\$0.00	\$0.00	\$0.50	\$0.00	\$0.00	\$0.00	\$32.35	\$42.66

(*)Special Calculation Note :

Ratio :

3 Journeyman to 2 Apprentices or fraction thereof: 1-3 Journeymen to 2 Apprentice 4-6 Journeymen to 4 Apprentice first person assigned to any job site shall be a journeyman Construction Electrician and Construction Wireman Ratio There shall be a minimum ratio of one inside Journeyman to every (4) employees of different classification per jobsite. An inside Journeyman Wireman is required on the project as the fifth (5th) worker or when apprentices are used

Jurisdiction (* denotes special jurisdictional note) :

Butler, Warren*

Special Jurisdictional Note :

In Warren County the following townships are included: (Deerfield, Hamilton, Harlan, Massie, Salem, Turtle Creek, Union, and Washington) The scope of work for the light commercial agreement shall apply to the following facilities not to exceed 200,00 square feet; office buildings, shopping centers, auto sales agencies and garages, churches, funeral homes, nursing homes, hotels, retail and wholesale facilities, small stand-alone manufacturing facilities when free standing and not part of a larger facility (not to exceed 50,000 square fee), solar projects (500 panels or less) unless otherwise covered under the agreement, lighting retrofits (when not associated with remodels involving branch re-circuiting) lighting retrofits shall be defined as the changing of lamps and ballasts in existing light fixtures and shall also include the one for one replacement of existing fixtures, warehouses, gas stations, food service centers, restaurants, entertainment facilities, hospitals, clinics, motels, residential buildings.

Details :

Electricians while splicing cable shall receive \$.50 an hour above the regular electrical rate. All work that requires the use of gas masks or respirators, shall be paid 50% above the appropriate rate of pay. Work up to & including 40 feet shall be paid \$.50 over

the journeyman rate. All work from a Boatswain Chair, Swinging Scaffold, or Barrel shall be at double the Journeyman rate. Workmen required to work 50 feet or more below the surface of the earth will be paid 50% above the Journeyman rate.

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 688 Inside Lt Commercial South West

Type of Rate: Commercial

Change #:
LCN01-2025ib

Craft:
Electrical

Effective Date:
2/12/2025

Effective Date:
2/12/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overti me Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Electrician	\$36.80		\$9.70	\$7.75	\$0.60	\$0.00	\$3.11	\$1.10	\$0.00	\$0.00	\$59.06	\$77.46
Over 50 feet	\$73.60		\$9.70	\$7.75	\$0.60	\$0.00	\$3.11	\$2.20	\$0.00	\$0.00	\$96.96	\$133.7
CE-3 12,001-14,000 Hrs	\$28.67		\$6.83	\$0.86	\$0.92	\$0.00	\$0.86	\$0.00	\$0.00	\$0.00	\$38.14	\$52.48
CE-2 10,001-12,000 Hrs	\$22.94		\$6.83	\$0.69	\$0.92	\$0.00	\$0.69	\$0.00	\$0.00	\$0.00	\$32.07	\$43.54
CE-1 8,001-10,000 Hrs	\$21.03		\$6.83	\$0.63	\$0.92	\$0.00	\$0.63	\$0.00	\$0.00	\$0.00	\$30.04	\$40.56
CW-4 6,001-8,000 Hrs	\$19.12		\$6.83	\$0.57	\$0.92	\$0.00	\$0.57	\$0.00	\$0.00	\$0.00	\$28.01	\$37.57
CW-3 4,001-6,000 Hrs	\$17.20		\$6.83	\$0.52	\$0.92	\$0.00	\$0.52	\$0.00	\$0.00	\$0.00	\$25.99	\$34.59
CW-2 2,001-4,000 Hrs	\$16.25		\$6.83	\$0.49	\$0.92	\$0.00	\$0.49	\$0.00	\$0.00	\$0.00	\$24.98	\$33.11
CW-1 0-2,000 Hrs	\$15.29		\$6.83	\$0.46	\$0.92	\$0.00	\$0.46	\$0.00	\$0.00	\$0.00	\$23.96	\$31.61
Apprentice	BHR	Percent										
1st Period	\$18.40	\$50.00	\$9.70	\$0.00	\$0.60	\$0.00	\$0.00	\$0.55	\$0.00	\$0.00	\$29.25	\$38.45

2nd Period	\$20.24	\$55.00	\$9.70	\$0.00	\$0.60	\$0.00	\$0.00	\$0.61	\$0.00	\$0.00	\$31.15	\$41.27
3rd Period	\$22.08	\$60.00	\$9.70	\$7.75	\$0.60	\$0.00	\$3.11	\$0.66	\$0.00	\$0.00	\$43.90	\$54.94
4th Period	\$23.92	\$65.00	\$9.70	\$7.75	\$0.60	\$0.00	\$3.11	\$0.72	\$0.00	\$0.00	\$45.80	\$57.76
5th Period	\$27.60	\$75.00	\$9.70	\$7.75	\$0.60	\$0.00	\$3.11	\$0.83	\$0.00	\$0.00	\$49.59	\$63.39
6th Period	\$31.28	\$85.00	\$9.70	\$7.75	\$0.60	\$0.00	\$3.11	\$0.94	\$0.00	\$0.00	\$53.38	\$69.02
	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$

(*)Special Calculation Note :

Other is NEBF (National Electrical Benifit Fund) and Administration Fund

Ratio :

Journeyman 1-3 to 2 Apprentice Journeyman 4-6 to 4 Apprentice Journeyman 7-9 to 6 Apprentice Etc. Construction Electrician and Construction Wireman Ratio There shall be a minimum ratio of one inside Journeyman to every (4) employees of different classification per jobsite. An inside Journeyman Wireman is required on the project as the fifth (5th) worker or when apprentices are used.

Jurisdiction (* denotes special jurisdictional note) :

Ashland, Crawford, Huron*, Knox*, Marion, Morrow, Richland, Wyandot*

Special Jurisdictional Note :

In Knox County the following townships: Liberty, Clinton, Union, Howard, Monroe, Middleberry, Morris, Wayne, Berlin, Pike, Brown, Jefferson. In Wyandot County the following townships: Sycamore, Crane, Eden, Pitt, Antrim and Tymochee. In Huron County the following townships: Richland, New Haven, Ripley, and Greenwich. The scope of work for the light commercial agreement shall apply to the following facilities not to exceed 200,000 square feet; office buildings, shopping centers, auto sales agencies and garages, churches, funeral homes, nursing homes, hotels, retail and wholesale facilities, small stand-alone manufacturing facilities when free standing and not part of a larger facility (not to exceed 50,000 square fee), solar projects (500 panels or less) unless otherwise covered under the agreement, lighting retrofits (when not associated with remodels involving branch re-circuiting) lighting retrofits shall be defined as the changing of lamps and ballasts in existing light fixtures and shall also include the one for one replacement of existing fixtures, warehouses, gas stations, food service centers, restaurants, entertainment facilities, hospitals, clinics, motels, residential buildings.

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Ironworker Local 172

Type of Rate: Commercial

Change #:

LCN01-2025ib

Craft:

Ironworker

Effective Date:

6/11/2025

Effective Date:

6/11/2025

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overti me Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET	MISC		

									(*)	(*)		
Classification												
Ironworker	\$40.87		\$9.50	\$9.50	\$0.71	\$0.00	\$3.50	\$0.00	\$0.00	\$0.00	\$64.08	\$84.52
Rigger Welder Reinforcing Sheeter Fence Erector Machinery Mover	\$40.87		\$9.50	\$9.50	\$0.71	\$0.00	\$3.50	\$0.00	\$0.00	\$0.00	\$64.08	\$84.52
Apprentice	BHR	Percent										
1st Year 0-1500 Hours	\$28.61	\$70.00	\$9.50	\$9.50	\$0.71	\$0.00	\$3.50	\$0.00	\$0.00	\$0.00	\$51.82	\$66.12
2nd Year 1501-3000 Hours	\$32.70	\$80.00	\$9.50	\$9.50	\$0.71	\$0.00	\$3.50	\$0.00	\$0.00	\$0.00	\$55.91	\$72.25
3rd Year 3001-4500 Hours	\$36.79	\$90.02	\$9.50	\$9.50	\$0.71	\$0.00	\$3.50	\$0.00	\$0.00	\$0.00	\$60.00	\$78.40

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Champaign*, Clark*, Crawford*, Delaware, Fairfield, Fayette*, Franklin, Hardin*, Highland*, Hocking, Jackson*, Knox, Licking, Logan*, Madison*, Marion, Morrow, Perry, Pickaway, Pike, Ross, Union, Vinton, Wyandot*

Special Jurisdictional Note :

Champaign County Twps included: Wayne, Rush, Goshen. Clark County Twps included: Vienna, Catawba and portions of Harmony and Pleasant Crawford County Twps included: Bucyrus, Dallas, Jefferson, Jackson, Whetstone, Polk, Sandusky. Fayette County Twps included: Paint, Marion, Perry, Madison, Wayne, Union. Hardin County Twps included: McDonald, Taylorcreek, Hale, Dudley, Pleasant, Goshen, Blanchard, Lynn, Jackson, Buck, Cessna, Marion, Washington. Highland County Twps included: Madison. Jackson County Twps included: Liberty, Washington, Milton, Jackson, Coal, Wilkesville. Logan County Twps included: Monroe, Zane, Jefferson, Perry, Rush Creek, Bokes Creek. Madison County Twps included: Range, Paint, Fairfield, Sommerford, Jefferson, Pike, Canaan, Pleasant, Oak Run, Union, Deer Creek, Monroe, Darby. Pike County Twps included: Perry, Benton, Mifflin, Sunfish, Newton, Prebble, Pee Pee, Seal, Beaver, Jackson. Wyandot County Twps included: Jackson, Marseilles, Mifflin, Pitt, Antrim.

Muskingum County includes: Jackson, Licking, Hope Well, Newton, Clay, Cass, Muskingum falls, Springfield, Madison, Washington, Wayne, Brush Creek.

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Labor Local Residential (Columbus)

Type of Rate: Residential

Change #:

CN00001

Craft:
Laborer

Effective Date:
9/28/1996

Effective Date:
9/28/1996

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overti me Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Laborer	\$15.30		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$15.30	\$22.95
Apprenti ce	BHR	Percent										

(*)Special Calculation Note :

Ratio :

Jurisdiction (* denotes special jurisdictional note) :
Fairfield, Fayette, Franklin, Hocking, Licking, Madison, Pickaway, Union

Special Jurisdictional Note :

Details :

Prevailing Wage Rate Skilled Crafts
Name of Union: Labor Local Residential (Delaware)
Type of Rate: Residential

Change #:
CN00001

Craft:
Laborer

Effective Date:
9/28/1996

Effective Date:
9/28/1996

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overti me Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Laborer	\$14.42		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$14.42	\$21.63	
Apprenti ce	BHR	Percent										

(*)Special Calculation Note :

Ratio :

Jurisdiction (* denotes special jurisdictional note) :

Delaware

Special Jurisdictional Note :**Details :****Prevailing Wage Rate Skilled Crafts****Name of Union:** Labor Local Residential (Mansfield)**Type of Rate:** Residential**Change #:**

CN00001

Craft:

Laborer

Effective Date:

9/28/1996

Effective Date:

9/28/1996

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Laborer	\$14.42		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$14.42	\$21.63
Apprentice	BHR	Percent										

(*)Special Calculation Note :**Ratio :****Jurisdiction (* denotes special jurisdictional note) :**

Ashland, Crawford, Knox, Morrow, Richland

Special Jurisdictional Note :**Details :****Prevailing Wage Rate Skilled Crafts****Name of Union:** Operating Engineers Local 66 Building & Hwy**Type of Rate:** Commercial**Change #:**

LCN01-2025ib

Craft:

Operating Engineer

Effective Date:

6/1/2025

Effective Date:

6/1/2025

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Operator Class 1	\$39.72		\$10.65	\$8.35	\$0.76	\$0.00	\$5.20	\$0.10	\$0.00	\$0.00	\$64.78	\$84.64
Group 2	\$34.25		\$10.65	\$8.35	\$0.76	\$0.00	\$5.20	\$0.10	\$0.00	\$0.00	\$59.31	\$76.44
Group 3	\$30.96		\$10.65	\$8.35	\$0.76	\$0.00	\$5.20	\$0.10	\$0.00	\$0.00	\$56.02	\$71.50
Group 4	\$28.13		\$10.65	\$8.35	\$0.76	\$0.00	\$5.20	\$0.10	\$0.00	\$0.00	\$53.19	\$67.26
Group 5	\$39.99		\$10.65	\$8.35	\$0.76	\$0.00	\$5.20	\$0.10	\$0.00	\$0.00	\$65.05	\$85.05
Group 6	\$40.72		\$10.65	\$8.35	\$0.76	\$0.00	\$5.20	\$0.10	\$0.00	\$0.00	\$65.78	\$86.14
Group 7	\$41.72		\$10.65	\$8.35	\$0.76	\$0.00	\$5.20	\$0.10	\$0.00	\$0.00	\$66.78	\$87.64
Group 8	\$42.72		\$10.65	\$8.35	\$0.76	\$0.00	\$5.20	\$0.10	\$0.00	\$0.00	\$67.78	\$89.14
Group 9	\$43.72		\$10.65	\$8.35	\$0.76	\$0.00	\$5.20	\$0.10	\$0.00	\$0.00	\$68.78	\$90.64
Group 10	\$44.72		\$10.65	\$8.35	\$0.76	\$0.00	\$5.20	\$0.10	\$0.00	\$0.00	\$69.78	\$92.14
Group 11	\$40.22		\$10.65	\$8.35	\$0.76	\$0.00	\$5.20	\$0.10	\$0.00	\$0.00	\$65.28	\$85.39
Apprentice	BHR	Percent										

(*)Special Calculation Note :

Other: Benefit Fund For Apprentice Calculations please use the following wage reductions for the appropriate classifications worked: 1st year \$4.00 less than Journeyman Rate of each Classification used plus full fringes 2nd year \$3.50 less than Journeyman Rate of each Classification used plus full fringes 3rd year \$2.50 less than Journeyman Rate of each Classification used plus full fringes 4th year \$2.00 less than Journeyman Rate of each Classification used plus full fringes NOTE: IN ADDITION TO THE APPRENTICE WAGE RATES & FULL FRINGES THE EMPLOYER SHALL PAY 1.00 PER HOUR ADDITIONAL FOR APPRENTICESHIP TRAINING FOR EACH APPRENTICE HOUR WORKED.

Ratio :

5 Operating Engineers to 1 Apprentice Per Job

Jurisdiction (* denotes special jurisdictional note) :

Columbiana, Mahoning, Trumbull

Special Jurisdictional Note :

Details :

Group 1 - Asphalt Heater Planer; Excavators (all types) Back Hoe (all types); Back Hoe with Shear Attachment; Batch Plant (Central Mix Concrete) ; Batch Plant (portable Concrete): Berm Builder (automatic); Backfiller with drag attachment; Boat Derrick; Boat (tug); Boom Truck; Boring Machine (when attached to tractor); Bullclam; Bulldozer; CMI; Road Builders or similar types; Cable Placer & Layer ; Carrier (Straddle); Chicago Boom; Compactor with blade attached; Concrete Pump; Concrete Saw Veneer or similar type; Concrete Spreader Finisher; Combination (Bidwell Machine); Crane (Electric Overhead, Rough Terrain, Truck, Tower); Derricks (boom, car); Diggers-Wheel (not Trencher or Road Widener); Double Nine; Drag Line; Dredge; Drill-Kenny or similar type; Easy Pour Median Barrier Machine (or similar type); Electromatic; Environmental Maintenance Mechanic; Frankie Pile; Gradall; Grader: Gurry; Gurry (self propelled); Heavy Equipment Robotics Operator/Mechanic; Hoist - Monorail; Hoist-Stationary & Mobile Tractor; Hoist - Two or three drum; Horizontal Directional Drill Operator; Jackall; Jumbo Machine; Kocal or Kuhlman; Land/Seagoing Vehicle; Loader-Elevating; Loader-Front End; Loader-Skid Steer; Locomotive; Mechanic; Mechanic as Welder; Metro Chip Harvester with Boom; Mucking Machine; Paver-Asphalt; Paver-Road Concrete; Paver-Slip Form (C.M.I. or similar type); Post Driver (Carrier Mounted); Power Driven Hydraulic Pumps & Jacks (When used in Slip Form or Lift Slab Construction); Quick Change Barrier Machine; Regulator-Ballast; Rigs-Drilling; Roto Mill (or similar); Scraper/Pan; Shovel; Shuttle Buggy; Side Boom; Slip Form Curb Machine; Speedswing; Spikemaster; Stonecrusher; Tie Puller; Tie Tamper (Single or Multihead); Tire Truck (Assigned to job); Tractor-Double Boom; Tractor with Attachment; Trenching Machine; Tunnel Machine (Mark 21 Java or similar type); Whirley (Or Similar Type); Group 2 - Asphalt Plant; Bending Machine (Pipeline or Similar type); Boring Machine (Motor Driven); Chip Harvester (Without Boom); Cleaning

Machine(Pipeline Type);Coating Machine (Pipeline Type);Compactor;Concrete Belt Placer;Concrete Finisher;Concrete Planer or Asphalt;Concrete Spreader;Elevator;Fork Lift (Home building only);Fork Lift Walk Behind (Hoisting over one buck high);Form Line Machine;Grease Truck Operator;Grout Pump; Gunnite Machine;Horizontal Directional Drill Locator;Huck Bolting Machine;Hydraulic Scaffold (Hoisting building Materials);Paving Breaker
(Self-Propelled or Ridden);Pipe Dream;Pot Fireman (Power Agitated)Refrigeration Plant;Road Widener: Roller; Sasgen Derrick;Seeding Machine;Single Drum Hoist (With or Without Tower);Soil Stabilizer (Pump Type);Spray Cure Machine (Self-Propelled);Straw Blower Machine;Sub-Grader;Tube Finisher or Broom (C>M>I> or similar type);Tugger Hoist ,Fork-lifts and Lulls. Group 3 - Air Curtain Destructor (Or similar Type);Batch Plant-Job Related;Boiler Operator;Compressor;Conveyor;Curb Builder (Self Propelled);Drill Wagon;Generator
Sets;Generator-Steam;Heaters-Portable Power;Hydraulic Manipulator Crane;Hydraulic Power Unit (Not attached to rig for Pile driving Operation);Jacks-Hydraulic (Power Driven);Jacks-Hydraulic (Railroad); Ladavator; Minor Machine Operator;Mixer-Concrete;Mulching Machine;Pin Puller;Power Boom;Pulverizer;Pump (Water or Similar);Road Finishing machine (Pull Type);Saw-Concrete (Self Propelled Highway Work);Signal Man;Spray Cure Machine
(Motor-Powered);Steam Jenny;Stump Cutter;Syphons;Tractor;Trencher-Form;Vibrator-Gasoline;Water Blaster;Welding Machine: Group 4 - Brakeman;Deck Hand;Fireman;Mechanics Helper;Oiler: 2nd Helper Operator on Excavators over 140,000 pounds and Cranes: All tower cranes and Hydraulic Cranes, Truck cranes, on tracks and rough terrain with a capacity over 50 tons. Group 5- Pile Driving Operation Group 5 thru 10- Cranes rated two hundred (200) ton or over shall receive an additional wage rate of one dollar (\$1.00) per hour. Group 6- 100 Feet to 150 Feet Boom & Jib Combination Group 7- 151 Feet to 200 Feet Boom & Jib Combination Group 8- 201 Feet to 250 Feet Boom & Jib Combination Group 9- 251 Feet to 300 Feet Boom & Jib Combination Group 10- 301- Feet to 350 Feet Boom & Jib Combination Group 11- Lead Engineer Note:

Equipment Operator / Field Mechanic, Grit Reclamation, Paint Mixer, Traffic Control, Boat Person, Driver Class 3 (0-5 Yrs. Exp.)	\$28.12	\$9.85	\$7.81	\$0.38	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$46.16	\$60.22
Equipment Operator / Field Mechanic, Grit Reclamation, Paint Mixer, Traffic Control, Boat Person, Driver Class 3 (5 plus Yrs. Exp.)	\$31.32	\$9.85	\$7.81	\$0.38	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$49.36	\$65.02
Concrete Sealing, Concrete Blasting/ Power Washing / Etc. Class 4	\$31.12	\$9.85	\$7.81	\$0.38	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$49.16	\$64.72

[illegible]

Blaster Class 2												
Equipment Operator / Field Mechanic, Grit Reclamation, Paint Mixer, Traffic Control, Boat Person Class 3	\$31.68		\$6.50	\$7.20	\$0.31	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$45.69	\$61.53
Concrete Sealing, Concrete Blasting/ Power Washing , Etc. Class 4	\$31.68		\$6.50	\$7.20	\$0.31	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$45.69	\$61.53
Quality Control/ Quality Assurance , Traffic Safety, Compete nt Person Class 5	\$31.68		\$6.50	\$7.20	\$0.31	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$45.69	\$61.53
Apprentice	BHR	Percent										
1st Year	\$25.14	\$65.00	\$2.30	\$6.50	\$0.31	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$34.25	\$46.82
2nd Year	\$27.08	\$70.00	\$2.30	\$6.50	\$0.31	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$36.19	\$49.72
3rd Year	\$30.94	\$80.00	\$2.30	\$6.50	\$0.31	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40.05	\$55.53
4th Year	\$34.81	\$90.00	\$2.30	\$6.50	\$0.31	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.92	\$61.33

(*)Special Calculation Note :

Apprentices shall be paid proper % of the classification above..

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Brown, Butler, Clermont, Clinton, Hamilton, Warren

Special Jurisdictional Note :

Details :

Industrial Work paid as commercial work above for each class which includes, Industrial Plants, repair garages, processing

plants, storage tanks, warehouses, skeletons structures, bridges unless highest point of clearance is 60 feet or more whether new or old construction offices and office buildings in industrial sites are at industrial rates. Heavy & Highway Bridges-Guard Rails- Light Poles. A hazardous steeplejack rate shall apply on radio towers, stacks, light towers, water towers, steeples, skeleton steel, and exterior industrial conveyors over 25 feet, where such items require steeplejack methods and the rate of pay shall be a \$1.00 per hour above the industrial rate. Steeplejack rate to apply to bridges where highest point of clearance is 60 feet. Class 1 – Abrasive blasting of any kind. Class 2 – Bridge painting, coating application of any kind. All steel surface preparation other than abrasive blasting. All necessary rigging and containment building. All remedial/ spot blasting. Class 3 – Tend to all equipment including but not limited to abrasive blasting, power washing, spray painting, forklifts, hoists, trucks, etc. Load and unload trucks, handle materials, man safety boats, handle traffic control, clean up/ vacuum abrasive blast materials and related tasks. Class 4 – All aspects of concrete coating/ sealing including but not limited to preparation, containment, etc. Class 5 – Verify and record that all work is completed according to job specifications. Assure that all health and safety standards are adhered to. Assure all traffic is safely handled.

Prevailing Wage Rate Skilled Crafts

Name of Union: Painter Local 555 Industrial

Type of Rate: Commercial

Change #:

LCN01-2024ib

Craft:

Painter

Effective Date:

6/5/2024

Effective Date:

6/5/2024

[illegible]

3rd Year	\$28.24	\$60.49	\$12.30	\$8.53	\$0.66	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$49.73	\$63.85
4th Year	\$32.83	\$70.33	\$12.30	\$10.63	\$0.76	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$56.52	\$72.94
5th Year	\$37.39	\$80.09	\$12.30	\$10.87	\$0.85	\$0.00	\$3.35	\$0.00	\$0.00	\$0.00	\$64.76	\$83.45

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice 2 - 4 Journeymen to 2 Apprentices 5 - 7 Journeymen to 3 Apprentices 8 - 10 Journeymen to 4 Apprentices

Jurisdiction (* denotes special jurisdictional note) :

Champaign, Clark, Clinton, Darke, Fayette, Greene, Miami, Montgomery, Preble

Special Jurisdictional Note :

Details :

Wage rate covers: all plumbing, pipefitting, heating, refrigeration and air conditioning work.

Prevailing Wage Rate Skilled Crafts

Name of Union: Plumber Pipefitter Local 50 Residential

Type of Rate: Residential

Change #:

LCN01-2025ib

Craft:

Plumber

Effective Date:

6/30/2025

Effective Date:

6/30/2025

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Plumber	\$34.84		\$9.40	\$1.65	\$1.15	\$0.00	\$1.49	\$0.00	\$0.00	\$0.00	\$48.53	\$65.95
Pipefitter												
Apprentice	BHR	Percent										
1st year	\$17.42	\$50.00	\$9.40	\$1.65	\$1.15	\$0.00	\$1.49	\$0.00	\$0.00	\$0.00	\$31.11	\$39.82
2nd year	\$20.90	\$60.00	\$9.40	\$1.65	\$1.15	\$0.00	\$1.49	\$0.00	\$0.00	\$0.00	\$34.59	\$45.05
3rd year	\$26.13	\$75.00	\$9.40	\$1.65	\$1.15	\$0.00	\$1.49	\$0.00	\$0.00	\$0.00	\$39.82	\$52.89
4th year	\$31.36	\$90.02	\$9.40	\$1.65	\$1.15	\$0.00	\$1.49	\$0.00	\$0.00	\$0.00	\$45.05	\$60.73

(*)Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice 2 Journeyman to 2 Apprentice 3 Journeyman to 3 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

Defiance, Fulton, Hancock, Henry, Lucas, Ottawa, Paulding, Putnam, Sandusky, Seneca, Williams, Wood

Special Jurisdictional Note :

Details :**Prevailing Wage Rate Skilled Crafts****Name of Union:** Roofer Local 44**Type of Rate:** Commercial**Change #:**

LCN01-2025ib

Craft:

Roofer

Effective Date:

5/21/2025

Effective Date:

5/21/2025

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Roofer	\$40.15	\$9.64	\$11.15	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$61.49	\$81.57
Applicant & Helper Trainees	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
0 to 1851 hrs	\$18.07	\$0.60	\$0.50	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$19.72	\$28.76
1852 to 3350 hrs	\$22.08	\$9.64	\$11.15	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$43.42	\$54.46
3351 to 4850 hrs	\$28.11	\$9.64	\$11.15	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$49.45	\$63.51
4851 to 6350 hrs	\$31.12	\$9.64	\$11.15	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$52.46	\$68.02
6351 to 7550 hrs	\$36.14	\$9.64	\$11.15	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$57.48	\$75.55
7551 hrs	\$40.15	\$9.64	\$11.15	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$61.49	\$81.57
Apprentice	Percent										
Start of school	\$50.02	\$0.60	\$0.50	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$21.73	\$31.77
600 hrs worked/72 school hrs	\$55.00	\$0.60	\$0.50	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$23.73	\$34.77
1200 hrs worked/144 school hrs	\$60.00	\$9.64	\$11.15	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$45.43	\$57.48

1800 hrs worked/216 school hrs	\$65.00	\$9.64	\$11.15	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$47.44	\$60.49
2400 hrs worked/288 school hrs	\$70.02	\$9.64	\$11.15	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$49.45	\$63.51
3000 hrs worked/360 school hrs	\$75.00	\$9.64	\$11.15	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$51.45	\$66.51
3600 hrs worked/432 school hrs	\$80.00	\$9.64	\$11.15	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$53.46	\$69.52
4200 hrs worked/504 school hrs	\$90.02	\$9.64	\$11.15	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$57.48	\$75.55
4800 hrs/576 school hrs	\$100.00	\$9.64	\$11.15	\$0.49	\$0.00	\$0.00	\$0.06	\$0.00	\$0.00	\$61.49	\$81.57

(*)Special Calculation Note :

Other is for Drug Testing.

Ratio :

2 Journeymen to 1 Apprentice 1 Applicant/Helper Trainee

Jurisdiction (* denotes special jurisdictional note) :

Ashtabula, Cuyahoga, Erie, Geauga, Lake, Lorain*, Sandusky

Special Jurisdictional Note :

Lorain (The Ohio Turnpike North)

Details :

Prevailing Wage Rate Skilled Crafts**Name of Union:** Truck Driver Bldg & Heavy Hwy**Type of Rate:** Residential**Change #:**

1/1/2006

Craft: Effective Date:

7/1/2006

Effective Date:

7/1/2006

	BHR		Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification												
Truck Driver Class 1 wheel service trucks-4w wheel dump trucks-batch trucks-Oil Distributor-Asphalt Distributor Tandems	\$18.04		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$18.04	\$27.06
Apprentice	BHR	Percent										

(*)Special Calculation Note :

No special calculations for this skilled craft wage rate are required at this time.

Ratio :**Jurisdiction (* denotes special jurisdictional note) :**

Franklin

Special Jurisdictional Note :

Details :

END OF SECTION

SECTION 01000

GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 DEFINITIONS

- A. The following definitions are provided for use with the Montgomery County Environmental Services Standard Specifications. If a set of Contract Documents directly includes or makes an indirect reference or appeal to the Montgomery County Environmental Services Standard Specifications, the definitions contained in those Contract Definitions shall supersede the definitions contained in this section. Note that capitalization of entire words or individual letters is not intended to convey any information other than the typical meaning of the word or phrase as used throughout the Montgomery County Environmental Services Standard Specifications.
- B. Bid Form: The document used to outline payment quantities and methods included with the Contract Documents and signed by the CONTRACTOR.
- C. Contract Documents: Documents including all drawings, specifications, bid data, forms, agreements, contract conditions, addenda, etc. governing the terms, conditions and scope of the work and providing the required detail for construction as well as administration of the work and defined in the agreement signed by the CONTRACTOR.
- D. Contract Drawings: Information contained, referenced and in any way made a part of the Contract Documents provided in the form of drawings to describe the required work for a specific project.
- E. CONTRACTOR: The person, firm or corporation performing work under an agreement with the OWNER or under an agreement with another party (e.g. the Montgomery County Engineer, a township, etc.) and whose work, or any part thereof, must by ordinance, law, or regulation comply with the latest version of the Montgomery County Environmental Services Standard Specifications and the Montgomery County Environmental Services Rules and Regulations.
- F. Details: Sketches, figures and tables included in the Montgomery County Environmental Services Standard Specifications. Details may also include sketches and figures shown on the drawings to describe work that is specific to a certain project.
- G. Drawings: See Contract Drawings.
- H. ENGINEER: The Sanitary Engineer of Montgomery County, Ohio or the OWNER's duly authorized representative.
- I. OWNER: The Board of County Commissioners, Montgomery County, Ohio.
- J. Specifications: The Montgomery County Environmental Services Standard and Supplemental Specifications. Specifications is further defined as those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards, and workmanship as applied to the work and certain administrative details applicable thereto. Specifications shall also include written technical

descriptions including detail drawings that are included, referenced and in any way made part of the Contract Documents.

- K. Project: An identifying name, title, number or similar description assigned to reference the work.
- L. Work: Any work performed by a CONTRACTOR that modifies, expands or otherwise impacts the Montgomery County water supply or sewage collection and treatment facilities and required to be furnished under the Contract Documents.
- M. PROVISIONAL APPROVAL: The Sanitary Engineer of Montgomery County or duly authorized designee shall have the authority to grant Provisional Approval for modification of the specifications herein. The Provisional Approval shall be subject to and limited by the conditions contained therein.

1.02 COORDINATION WITH OWNER'S WORKING HOURS

- A. All work requiring inspection, attention or presence for any reason of OWNER's personnel shall be performed during Montgomery County Environmental Services regular working hours. Regular working hours are 7:30 a.m. to 4:00 p.m. Monday through Friday.
- B. If CONTRACTOR wishes to perform regular Work at times other than regular working hours, CONTRACTOR shall be required to pay the OWNER for the services of the Resident Project Representative and the ENGINEER at established rates on record in the office of Montgomery County Environmental Services.
- C. In the event of an emergency or other unplanned event due to the CONTRACTOR's work, negligence or otherwise attributable to the CONTRACTOR, CONTRACTOR shall submit payment for exact hours of overtime worked by OWNER's personnel.
- D. The CONTRACTOR shall give a minimum of two (2) weeks' notice of intent to work at times other than regular working hours to the Resident Project Representative and ENGINEER.
- E. ENGINEER has the right to deny permission, with due cause, for the CONTRACTOR to work at times other than regular working hours.
- F. When working within the existing public right-of-way, the CONTRACTOR shall erect construction signage at limits of work at least ten days in advance of commencement of any work advising of the start date and length of construction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01043

COORDINATION WITH OWNER'S OPERATIONS

PART 1 GENERAL

1.01 GENERAL

- A. The Montgomery County Environmental Services, Engineering, Field, and Water Reclamation Services groups has sole responsibility and authority over the control and operation of all County owned and operated facilities including water mains and services, sewer mains and laterals, pumping stations, water reclamation facilities, valves, meters and other related devices and appurtenances. Operation of existing valves, gates and other items of OWNER's facilities shall only be performed by the OWNER's Engineering, Operations, and Water Reclamation personnel.
- B. No work shall be undertaken which would jeopardize the minimum required operations of County facilities.
 - 1. Bypassing of sewage is strictly prohibited.
 - 2. Connection to or contact with the Montgomery County water supply system, other than by permit and through devices approved by Montgomery County, is strictly prohibited.
 - 3. All work shall conform to the Montgomery County Environmental Services Rules and Regulations, latest revision.
- C. All work necessary to complete modifications, connections, tie-ins, etc. to existing Montgomery County facilities shall be done in accordance with permits issued by Montgomery County Environmental Services. See additional information in Section 01046.
- D. CONTRACTOR shall allow full access for OWNER's personnel to all facilities.
- E. All CONTRACTORS shall perform all construction activities so as to avoid interference with operations of the OWNER's facilities and the work of others.
- F. OWNER shall have the authority to stop or prohibit Work which would interfere or jeopardize the continuous and reliable operation of OWNER's facilities.
- G. Disturbances to Operations:
 - 1. It is required that the existing and new facilities (as they come on line) operate continuously. Scheduled interruptions of any facility's operations, when allowed by permit, shall be coordinated with the Montgomery County Environmental Services, Engineering, Field, and Water Reclamation personnel. Frequency and duration of disturbance to these operations shall be minimized.
 - 2. Unscheduled interruption of operation of OWNER's facilities resulting from construction work under the CONTRACTOR's responsibility are strictly prohibited. If such unscheduled interruption occurs, operation of OWNER's facilities shall be returned at once to normalcy through temporary or permanent means. Temporary corrections shall be made permanent at the next scheduled interruption to operations if practicable, or as soon as practicable. All permanent corrections shall meet applicable requirements of OWNER.

3. Equipment and materials to be used for temporary purposes need not be new but shall be in serviceable condition and installed in a safe manner.
4. Temporary facilities shall be installed so as to minimize interference with construction and to meet OSHA, NEC and any other applicable laws', codes' or regulations' requirements.
5. Relocation of such temporary facilities may be required as construction progresses, the cost of which shall be paid for by the CONTRACTOR.
6. CONTRACTOR shall be liable for all costs and fines resulting from unscheduled interruption of the operation of the OWNER's facilities.

1.02 SEQUENCING AND OPERATIONS

A. General:

1. All new facilities shall be tested and in operating condition before the final tie-ins are made connecting the new facilities to the existing facilities. Comply with the requirements of Section 01046.

1.03 SUBMITTALS

- A. Submit detailed schedule of proposed modifications and connections, including proposed bypasses, shutdowns and tie-ins.
- B. Submittal shall include the proposed time and date as well as the anticipated duration.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01046

CONNECTIONS TO EXISTING FACILITIES

PART 1 GENERAL

1.01 GENERAL

- A. Perform all construction necessary to complete connections and tie-ins to existing facilities.
- B. Keep existing facilities in operation unless otherwise specifically permitted by OWNER. Comply with the requirements of Section 01043.
- C. All CONTRACTORS shall perform all construction activities so as to avoid interference with operations of OWNER's facilities and the work of others.
- D. It is the responsibility of each CONTRACTOR to maintain continuous operation of existing facilities while working in, on or around these facilities. Each CONTRACTOR shall protect the existing facilities by any means required including sheeting, shoring, bracing, patching, temporary piping, etc., however all means shall comply with OWNER's minimum standards.

1.02 BYPASSING

- A. All facilities must remain in operation at all times unless otherwise permitted by OWNER. Bypassing of sewage out of the Montgomery County sanitary sewer system is strictly prohibited. All bypasses involving sewage must return sewage to the Montgomery County sanitary sewer system without allowing the sewage to enter the environment. CONTRACTOR shall be liable for all costs and fines resulting from release of sewage out of the Montgomery County sewer system.
- B. If a bypass is required to complete certain segments of Work or to make a tie-in, the CONTRACTOR shall be responsible for all methods, means and costs including provision of all necessary labor and materials to perform the operation.
- C. Unless otherwise specifically permitted or approved by the OWNER, no interruption in service will be permitted during bypasses or tie-ins.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01100
SUMMARY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Work by Owner/Owner/Engineer.
 - 4. Work under separate contracts.
 - 5. Owner/Owner/Engineer-furnished products.
 - 6. Access to site.
 - 7. Coordination with occupants.
 - 8. Work restrictions.
 - 9. Specification and drawing conventions.
 - 10. Miscellaneous provisions.
 - 11. Design and Construction Document Management System.
- B. Related Requirements:
 - 1. Section 01 5000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner/Owner/Engineer's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: MCEs Eastern Regional Water Reclamation Facility Operations Building Renovation
 - 1. Project Location: 1802 Spaulding Road, Kettering, OH 45432.

- B. Owner/ Engineer: Montgomery County Environmental Services (MCES).
 - 1. Owner/Engineer's Purchasing Representative: Barabra Asberry, Montgomery County Purchasing Department; 937-225-6391, AsberryB@mcchio.org
 - 2. Owner's Representative: Rayshwn Bailey, Montgomery County GIS Administrator 937-781-2652, BaileyRA@mcchio.org
- C. Design Professionals: Chandra Wilson, SPGB Architects, LLC, 614-771-8963, cwilson@spgbarch.com. AoR Tom Gates.
- D. Design Professionals's Consultants: Design Professional has retained the following design professionals, who have prepared designated portions of the Contract Documents:
 - 1. Landscape Architect: John McGuire, Beam Designs, LLC, 614-659-7003, jmcguire@beamdesignsllc.com
 - 2. Structural Engineer: Niru Dabholkar, Barber & Hoffman, Inc., 614-825-9580, ndabholkar@barberhoffman.com
 - 3. Mechanical and Electrical Engineer: Drew Robinson, TEC, Inc., 614-267-4928, drobinson@tecinceng.com

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. This Project renovates the administrative portion of the existing Operations Building. Areas of renovation on the first floor include expanding the laboratory, relocating the lunchroom, renovating the locker rooms, and restrooms. Areas of renovation on the second floor include the assembly room, office space and several single use restrooms. The building has been surveyed for hazardous materials and determined abatement isn't required.
 - 2. Exterior building envelope improvements include selective demolition and replacement of windows located within the renovation areas and selected exterior handrail repairs.
 - 3. Renovations to individual restrooms located in the Secondary Building and the Maintenance Building are also included in the scope of work. The renovation areas have been surveyed for hazardous materials, and it was determined that abatement is not required.
 - 4. The building's normal power, telecommunications distribution and fire alarm will be expanded and redistributed to meet new requirements. Lighting and controls, door access control, and security system will be replaced within the renovated areas.
 - 5. The Owner will provide movable furnishings and laboratory equipment as described on the drawings.
- B. Type of Contract:
 - 1. Project will be constructed as a single prime contract.

1.5 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contractor other contracts. Coordinate the Work of this Contract with work performed under separate contracts.
- B. Preceding Work: Owner/Engineer has awarded separate contract(s) for the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.
 - 1. None.
- C. Concurrent Work: Owner/Engineer will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
 - 1. Telecommunication equipment during work. Coordinate with Owner/Engineer to schedule work.
 - 2. Security Cameras and card readers
 - 3. EV charger.
- D. Subsequent Work: Owner/Owner/Engineer will award separate contract(s) for the following additional work to be performed at site following Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.
 - 1. Owner/Owner/Engineer to provide movable furnishings and laboratory equipment.

1.6 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.7 CONTACTOR'S USE OF SITE AND PERMISES

- A. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Limits on Use of Site: Limit use of Project site to Work in areas as indicated. Do not disturb portions of the Project site beyond areas in which the Work is indicated.
 - 1. Limits on Use of Site: Confine construction operations to as indicated on Drawings.
 - 2. Driveways, Walkways and Entrances: Keep driveway, loading areas, and entrances serving premises clear and available to Owner/Owner/Engineer, Owner/Owner/Engineer's

employees, and emergency vehicles always. Do not use these areas for parking or for storage of materials.

- a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

- A. Full/Partial Owner Occupancy: Owner will occupy the building and premises during entire construction period, with the exception of areas under construction excluding the corridors, stairs, and window work these areas will be occupied during construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, egress stairs, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 2. Provide not less than 1 week and 72 hours notice to Owner of activities that will affect Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
1. Design professional will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed work as needed.
 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy as needed.
 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On

occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.

4. On occupancy, Owner will assume responsibility for maintenance and custodial service of occupied portions of Work.

1.9 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours as indicated on Section 01000 "General Requirements".
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner/Owner/Engineer or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 1. Notify Owner/Owner/Engineer not less than two days in advance of proposed utility interruptions.
 2. Obtain Owner/Owner/Engineer's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner/Owner/Engineer occupancy with Owner/Owner/Engineer.
 1. Notify Owner/Owner/Engineer not less than two days in advance of proposed disruptive operations.
 2. Obtain Owner/Owner/Engineer's written permission before proceeding with disruptive operations.
- E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes. Additionally, this policy applies to any vapor-emitting electronic smoking devices, including but not limited to those designed to resemble cigarettes, cigars, cigarillos, and pipes.
- F. Controlled Substances: Use of tobacco products and other controlled substances within the existing building is not permitted.
- G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times. Badging for access to the Administration Building will be provided on an as-needed basis.
- H. Employee Screening: Comply with Owner/Owner/Engineer's requirements for drug and background screening of Contractor personnel working on Project site.
 1. Maintain list of approved screened personnel with Owner/Owner/Engineer's representative.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

1.11 DESIGN AND CONSTRUCTION DOCUMENT MANAGEMENT SYSTEM

- A. Project files will be transferred electronically.

1.12 MISCELLANEOUS PROVISIONS

- A. Coordination Table: Refer to "Specification Coordination Table" for the coordination of each of the specification trades responsibilities immediately following this specification section.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 011000

SECTION 01150

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 DESCRIPTION

- A. CONTRACTOR shall furnish all labor, materials, tools, equipment, appurtenances and all services necessary to perform all Work required at the CONTRACTOR's lump sum or unit prices listed herein and/or on the Bid Form.
- B. The items listed below, beginning with Article 1.03, refer to and are the same pay items listed in the Bid Form. They constitute all of the pay items for the completion of the Work. No direct or separate payment will be made for providing miscellaneous temporary or accessory work, plants, services, CONTRACTOR's or ENGINEER's field offices, layout surveys, job signs, sanitary requirements, testing, safety devices, approval and record drawings, water supplies, power, maintaining traffic, removal of waste, watchmen, bonds, insurance, etc. and all other requirements of the General Conditions, Supplementary Conditions, and the General Requirements unless specifically listed on the Bid Form, this Section or requested by the ENGINEER. Compensation for all such services, items and materials shall be included in the CONTRACTOR's prices bid for the lump sum and unit price pay items listed herein and/or on the Bid Form.
- C. Each lump sum price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR's overhead and profit.

1.02 RELATED PROVISIONS

- A. Payments to CONTRACTOR: Refer to General Conditions and Agreement.
- B. Changes in Contract Price: Refer to General Conditions.
- C. Schedule of Values: Refer to Section 01370.

1.03 CONTRACT NO. 1- GENERAL

- A. Item 1 - General Construction:
 - 1. Description: Item 1 includes all general construction required for completing the general construction Work as shown and/or specified.
 - 2. Measurement and Payment: The lump sum payment for Item 1 will be in monthly payments for completing all general construction Work required to construct the Project, as shown on the Drawings and/or specified under Divisions 1 through 32 and other related divisions but not specifically included under other items and other Contracts. Payments will be made for completed work to date.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01250

SUBSTITUTION PROCEDURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 01600 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use facsimile of form provided in Project Manual.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Engineer and separate contractors, that will be necessary to accommodate proposed substitution.

- c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of Design Professionals.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from the Ohio Basic Building Code (OBC).
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Design Professional or Engineer Action: If necessary, Design Professional or Engineer will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Design Professional or Engineer will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Design Professional or Engineer Supplemental Instructions for minor changes in the Work.

- b. Use product specified if Design Professional or Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 – PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Design Professional will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Design Professional will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed unless otherwise indicated.

PART 3 – EXECUTION (NOT USED)

APPENDIX A

SUBSTITUTION REQUEST FORM

DATE: _____

TIME: _____

REQUEST NO.: _____

PROJECT: Montgomery County – MCES Environmental Lab

PROPOSED SUBSTITUTION: _____

REQUEST AUTHOR: _____ REQUIRED REPLY DATE: _____

REPLY: _____

REPLY AUTHOR: _____ REPLY DATE: _____

ATTACHMENTS: _____

ACTION REQUIRED: _____

DISTRIBUTION: _____

END OF SECTION 012500

SECTION 01260

CONTRACT MODIFICATION PROCEDURE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 01250 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

- A. Design Professional or Engineer will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, as Design Professional or Engineer "Supplemental Instructions."

1.4 PROPOSAL REQUESTS

- A. Engineer-Initiated Proposal Requests: Design Professional or Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Design Professional or Engineer are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

- c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use forms acceptable to Design Professional or Engineer.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Design Professional or Engineer.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 6. Comply with requirements in Section 01 2500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 - 7. Proposal Request Form: Use form acceptable to Design Professional or Engineer.

1.5 CHANGE ORDER PROCEDURES

- A. On Engineer's approval of a Work Changes Proposal Request, Design Professional will issue a Change Order for signatures of Engineer and Contractor.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Design Professional or Engineer may issue a Construction Change Directive. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 012600

SECTION 01310

CONSTRUCTION SCHEDULES

PART 1 GENERAL

1.01 GENERAL

- A. Provide construction schedule which conforms to the requirements below, unless otherwise approved by the ENGINEER.
- B. Update schedules every one (1) month unless otherwise specified or directed by the ENGINEER.
- C. In the preparation of the schedule, the CONTRACTOR shall take into consideration Shop Drawing submittal and approval time, the delivery times of equipment and materials, Subcontractors' work, availability and abilities of workmen, weather conditions, any restrictions in operations at the Work site, and all other items that may affect completion of the Work within the time requirements of the Contract Documents.

1.02 CONTENT

- A. Shop Drawing submittal dates and required approval dates.
- B. Product delivery dates.
- C. Factory and field-testing dates.
- D. Dates for beginning and completing each phase of the Work by activity and by trades. Include all milestone dates.
- E. Other data as required by the ENGINEER.

1.03 FORMAT

- A. Type: Horizontal bar chart.
- B. Sheet Size: 24-inches by 36-inches.
- C. Time Scale: Indicate first date in each work week.
- D. Organization:
 - 1. Show construction work by activity as the major schedule.
 - 2. Indicate critical activities which dictate rate of progress.
 - 3. Indicate Shop Drawing submittal dates by Specification Number.
 - 4. Indicate product delivery period after Shop Drawing approval and critical delivery date (latest date that does not impede the rate of work).
- E. Activity Designations: Show title and related Specification Section number.

1.04 SUBMITTALS

- A. Submit six (6) copies of initial schedule to the ENGINEER at least twenty (20) days prior to submitting first application for a progress payment but no later than twenty-one (21) days after the effective date of the Notice to Proceed.
- B. Submit six (6) copies of updated schedules at progress meetings. If a schedule remains unchanged from one period to the next, submit a written notice to that effect.
- C. Attach a letter of transmittal to each submittal and include the following information in the letter:
 - 1. A listing of items which have changed since the last submittal.
 - 2. Discussion of problems causing delays, anticipated length of delays, and proposed countermeasures.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 013100

PROJECT MANAGEMENT AND COORDINATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 01310 "Construction Schedule" for preparing and submitting Contractor's construction schedule.
 - 2. Section 01730 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 01771 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Engineer, Design Professional, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.

2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
- B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
 4. Coordinate installation of above ceiling items to account for the limited above ceiling clearance.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Engineer and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Design Professional will return RFIs submitted to Design Professional by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Design Professional.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.

13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716, or similar.
 1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Design Professional's Action: Design Professional will review each RFI, determine action required, and respond. Allow seven working days for Design Professional's response for each RFI. RFIs received by Design Professional after 1:00 p.m. will be considered as received the following working day.
 1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Design Professional's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Design Professional's action may include a request for additional information, in which case Design Professional's time for response will date from time of receipt of additional information.
 3. Design Professional's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01260 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Design Professional in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
 1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Design Professional.
 4. RFI number including RFIs that were returned without action or withdrawn.

5. RFI description.
 6. Date the RFI was submitted.
 7. Date Design Professional's response was received.
- F. On receipt of Design Professional's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Design Professional within seven days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Engineer and Design Professional of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Engineer and Design Professional, within three days of the meeting.
- B. Preconstruction Conference: The County will schedule and the Design Professional will conduct a preconstruction conference before starting construction.
1. Attendees: Authorized representatives of the County, Design Professional, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Critical work sequencing and long-lead items.
 - c. Designation of key personnel and their duties.
 - d. Lines of communications.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.

- i. Submittal procedures.
 - j. Preparation of record documents.
 - k. Use of the premises and existing building.
 - l. Work restrictions.
 - m. Working hours.
 - n. Engineer's occupancy requirements.
 - o. Responsibility for temporary facilities and controls.
 - p. Procedures for disruptions and shutdowns.
 - q. Construction waste management.
 - r. Parking availability.
 - s. Office, work, and storage areas.
 - t. Equipment deliveries and priorities.
 - u. First aid.
 - v. Security.
 - w. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Project Coordinator will conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Design Professional, of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.

- h. Possible conflicts.
 - i. Compatibility requirements.
 - j. Time schedules.
 - k. Manufacturer's written instructions.
 - l. Warranty requirements.
 - m. Compatibility of materials.
 - n. Acceptability of substrates.
 - o. Temporary facilities and controls.
 - p. Space and access limitations.
 - q. Regulations of authorities having jurisdiction.
 - r. Testing and inspecting requirements.
 - s. Installation procedures.
 - t. Coordination with other work.
 - u. Required performance results.
 - v. Protection of adjacent work.
 - w. Protection of construction and personnel.
- 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Project Coordinator will schedule and conduct a project closeout conference, at a time convenient to Engineer and Design Professional, but no later than 90 days prior to the scheduled date of Substantial Completion, or as requested by Engineer.
- 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 - 2. Attendees: Authorized representatives of the County, Design Professional, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Coordination of separate contracts.
 - k. Installation of Engineer's furniture, fixtures, and equipment.
 - l. Responsibility for removing temporary facilities and controls.
 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: The Project Coordinator will conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of the County, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to

ensure that current and subsequent activities will be completed within the Contract Time.

- (1) Review schedule for next period.
- b. Review present and future needs of each entity present, including the following:
 - (1) Temporary facilities and controls.
 - (2) Progress cleaning.
 - (3) Quality and work standards.
 - (4) Status of correction of deficient items.
 - (5) Field observations.
 - (6) Status of RFIs.
 - (7) Status of proposal requests.
 - (8) Pending changes.
 - (9) Status of Change Orders.
 - (10) Pending claims and disputes.
 - (11) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Project Coordinator will conduct Project coordination meetings at weekly intervals, as needed. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
 1. Attendees: In addition to representatives of the County, and Design Professional, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

- a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:
 - (1) Interface requirements.
 - (2) Sequence of operations.
 - (3) Status of submittals.
 - (4) Deliveries.
 - (5) Temporary facilities and controls.
 - (6) Work hours.
 - (7) Hazards and risks.
 - (8) Progress cleaning.
 - (9) Quality and work standards.
 - (10) Change Orders.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 013100

SECTION 01323

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
- B. Related Requirements:
 - 1. Section 01771 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
 - 2. Section 01790 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Engineer's personnel.
 - 3. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.

1.3 INFORMATIONAL SUBMITTALS

- A. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Submit photos on CD-ROM or thumb-drive. Include copy of key plan indicating each photograph's location and direction.
 - 2. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Design Professional.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of location, vantage point, and direction.
 - g. Unique sequential identifier keyed to accompanying key plan.
- B. Video Recordings: Submit video recordings within seven days of recording.

1. Submit video recordings on CD-ROM or thumb drive. Include copy of key plan indicating each video's location and direction.
2. Identification: With each submittal, provide the following information in file metadata tag:
 - a. Name of Project.
 - b. Name and address of photographer.
 - c. Name of Design Professional.
 - d. Name of Contractor.
 - e. Date video recording was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
3. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in three-ring binders. Provide label on front and spine. Include a cover sheet with label information. Include name of Project and date of video recording on each page.

1.4 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.
- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- C. File Names: Name media files with date and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs with maximum depth of field and in focus.
 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Design Professional.
 1. Take 50 photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
 2. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

SECTION 013300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

- 1. Submittal schedule requirements.
- 2. Administrative and procedural requirements for submittals.

B. Related Requirements:

- 1. Section 01310 "Construction Schedule" for submitting schedules and reports, including Contractor's construction schedule.
- 2. Section 01323 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
- 3. Section 01400 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
- 4. Section 01771 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
- 5. Section 01782 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
- 6. Section 01720 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
- 7. Section 01790 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Engineer's personnel.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Design Professional's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Design Professional's responsive action. Submittals may be rejected for not complying

with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Design Professional and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Design Professional's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
1. Project name.
 2. Date.
 3. Name of Design Professional.

4. Name of Contractor.
 5. Name of firm or entity that prepared submittal.
 6. Names of subcontractor, manufacturer, and supplier.
 7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
 8. Category and type of submittal.
 9. Submittal purpose and description.
 10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 11. Drawing number and detail references, as appropriate.
 12. Indication of full or partial submittal.
 13. Location(s) where product is to be installed, as appropriate.
 14. Other necessary identification.
 15. Remarks.
 16. Signature of transmitter.
- B. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Design Professional on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- C. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
- a. Design Professional will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Design Professional the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Design Professional's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Design Professional's action stamp.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Design Professional's action stamp.

1.7 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 4. For equipment, include the following in addition to the above, as applicable:

- a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
 1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Paper Transmittal: Include paper transmittal, including complete submittal information indicated.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

- a. Samples not incorporated into the Work, or otherwise designated as Engineer's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Design Professional will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Design Professional retain one Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Design Professionals and Engineers, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of

assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.8 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Design Professional.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.9 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Design Professional.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 1. Design Professional will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 DESIGN PROFESSIONAL'S REVIEW

- A. Action Submittals: Design Professional will review each submittal, indicate corrections or revisions required, and return.

1. PDF Submittals: Design Professional will indicate, via markup on each submittal, the appropriate action.
- B. Informational Submittals: Design Professional will review each submittal and will not return it, or will return it if it does not comply with requirements. Design Professional will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Design Professional.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Design Professional will return without review submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Design Professional without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

Name of Project

Corrections or comments made on the shop drawings during this review do not relieve contractor from compliance with requirements of the drawings and specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.

<u>Consultant Recommended Action Code</u>	<u>Montgomery County Environmental Services Action Code</u>
☐ No Exceptions Taken	☐ No Exceptions Taken
☐ Furnish as Corrected	☐ Furnish as Corrected
☐ Revise & Resubmit	☐ Revise & Resubmit
☐ Rejected	☐ Rejected
☐ Information Only	☐ Information Only
Signature: _____	Signature: _____
Printed Name: _____	Printed Name: _____
Date: _____	Date: _____

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SECTION 01351

ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes special procedures for alteration work.

1.2 DEFINITIONS

- A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.
- B. Consolidate: To strengthen loose or deteriorated materials in place.
- C. Design Reference Sample: A sample that represents the Design Professional's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.
- D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Design Professional.
- F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.
- G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
- H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.
- I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.
- J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.
- K. Retain: To keep an element or detail secure and intact.
- L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.3 COORDINATION

- A. Alteration Work Subschedule: A construction schedule coordinating the sequencing and scheduling of alteration work for entire Project, including each activity to be performed, and

based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration work.

1. Schedule construction operations in sequence required to obtain best Work results.
2. Coordinate sequence of alteration work activities to accommodate the following:
 - a. Engineer's continuing occupancy of portions of existing building.
 - b. Engineer's partial occupancy of completed Work.
 - c. Other known work in progress.
 - d. Tests and inspections.
3. Detail sequence of alteration work, with start and end dates.
4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
5. Use of elevator and stairs.
6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.

1.4 PROJECT MEETINGS FOR ALTERATION WORK

- A. Preliminary Conference for Alteration Work: Before starting alteration work, conduct conference at Project site.
 1. Attendees: In addition to representatives of Engineer, Design Professional, and Contractor, testing service representative, specialists, and chemical-cleaner manufacturer(s) shall be represented at the meeting.
 2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:
 - a. Alteration Work Subschedule: Discuss and finalize; verify availability of materials, specialists' personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Fire-prevention plan.
 - c. Governing regulations.
 - d. Areas where existing construction is to remain and the required protection.
 - e. Hauling routes.
 - f. Sequence of alteration work operations.
 - g. Storage, protection, and accounting for salvaged and specially fabricated items.
 - h. Existing conditions, staging, and structural loading limitations of areas where materials are stored.

- i. Qualifications of personnel assigned to alteration work and assigned duties.
 - j. Requirements for extent and quality of work, tolerances, and required clearances.
 - k. Embedded work such as flashings and lintels, special details, collection of waste, protection of occupants and the public, and condition of other construction that affects the Work or will affect the work.
3. Reporting: Record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.

1.5 INFORMATIONAL SUBMITTALS

- A. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.
- B. Alteration Work Program: Submit 15 days before work begins.
- C. Fire-Prevention Plan: Submit 15 days before work begins.

1.6 QUALITY ASSURANCE

- A. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.
- B. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.
 - 1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
 - 2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.
- C. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Engineer's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.
- D. Safety and Health Standard: Comply with ANSI/ASSP A10.6.

1.7 STORAGE AND HANDLING OF SALVAGED MATERIALS

- A. Salvaged Materials for Reinstallation:
 - 1. Repair and clean items for reuse as indicated.

2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.
- B. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Design Professional, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.
- C. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.
1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
 2. Secure stored materials to protect from theft.
 3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F or more above the dew point.

1.8 FIELD CONDITIONS

- A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of measured drawings and preconstruction photographs.
1. Comply with requirements specified in Section 013233 "Photographic Documentation."
- B. Discrepancies: Notify Design Professional of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.
- C. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.

1. Use only proven protection methods, appropriate to each area and surface being protected.
 2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
 3. Erect temporary barriers to form and maintain fire-egress routes.
 4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
 5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
 6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
 7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
- B. Temporary Protection of Materials to Remain:
1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
 2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.
- C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.
- D. Utility and Communications Services:
1. Notify Engineer, Design Professional, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
 2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
 3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.
- E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Design Professional immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.
1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
 2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.
- F. Existing Roofing: Prior to the start of work in an area, install roofing protection.

3.2 PROTECTION FROM FIRE

- A. General: Follow fire-prevention plan and the following:
1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled "Engineer's Responsibility for Fire Protection."
 2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
 - a. If combustible material cannot be removed, provide fire blankets to cover such materials.
- B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:
1. Obtain Engineer's approval for operations involving use of welding or other high-heat equipment. Use of open-flame equipment is not permitted. Notify Engineer at least 72 hours before each occurrence, indicating location of such work.
 2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
 3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
 4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
 5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
 6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:
 - a. Train each fire watch in the proper operation of fire-control equipment and alarms.
 - b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
 - c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
 - d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 1 hour after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.

- e. Maintain fire-watch personnel at each area of Project site until two hours after conclusion of daily work.
- C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.
- D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.
 - 1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

- A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.
- B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.
- C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.
- D. Neutralize alkaline and acid wastes and legally dispose of off Engineer's property.
- E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

- A. Have specialty work performed only by qualified specialists.
- B. Ensure that supervisory personnel are present when work begins and during its progress.
- C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs. Comply with requirements in Section 013233 "Photographic Documentation."
- D. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.
- E. Notify Design Professional of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Design Professional.

END OF SECTION 013516

SECTION 01370

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 GENERAL

- A. The Schedule of Values is an itemized list that establishes the value or cost of each part of the Work. It shall be used as the basis for preparing progress payments and may be used as a basis for negotiations concerning additional Work or credits which may arise during the construction. Quantities and unit prices may be included in the schedule when approved by or required by the ENGINEER.

1.02 PREPARATION

- A. Schedule shall show breakdown of labor, materials equipment and other costs used in preparation of the Bid. The schedule shall be properly balanced between all items and between labor and material for each item. The ENGINEER reserves the right to reject an unbalanced schedule.
- B. Costs shall be in sufficient detail to indicate separate amounts for each Section of the Specifications.
- C. CONTRACTOR may include an item for bond, insurance, temporary facilities and job mobilization. This item will be included for payment at a rate of twenty-five (25) percent per month for the first four (4) months.
- D. Schedule of Values shall be prepared on 8-1/2-inch by 11-inch white paper.
- E. Use Table of Contents of the Specifications as basis for Schedule format and identify each item with number and title in the Table of Contents. List sub-items of major products or systems as appropriate or when requested by ENGINEER.
- F. When requested by ENGINEER, support values with data that will substantiate their correctness.
- G. The sum of the individual values shown on the Schedule of Values must equal the total Contract Price.
- H. Each item shall include a directly proportional amount of the CONTRACTOR's overhead and profit.
- I. Each equipment item shall include all costs associated with starting and placing the equipment in operation, field testing the equipment, instructing the OWNER's personnel in the proper operation and maintenance of the equipment, and providing the equipment operation and maintenance data. Payment for equipment items will not exceed ninety (90) percent of the total item amount (labor and material) until all start-up, testing, training and O&M data requirements including as-built Record Drawings associated with the equipment item have been completed.
- J. Schedule shall show the purchase and delivery costs for materials and equipment that the CONTRACTOR anticipates he shall request payment for prior to their installation.

1.03 SUBMITTAL

- A. Submit Schedule to ENGINEER for approval at least twenty (20) days prior to submitting first application for a progress payment but not later than twenty-one (21) days after the effective date of the Notice to Proceed. After review by ENGINEER, revise and resubmit Schedule as required until it is approved.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01400
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
 - 1. Mockups are used for one or more of the following:
 - a. Verify selections made under Sample submittals.
 - b. Demonstrate aesthetic effects.
 - c. Demonstrate the qualities of products and workmanship.

- d. Demonstrate successful installation of interfaces between components and systems.
 - e. Perform preconstruction testing to determine system performance.
- 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
- 3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."
- I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Design Professional.

1.4 DELEGATED DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Design Professional.
- B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

- A. **Conflicting Standards and Other Requirements:** If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Design Professional regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Design Professional for clarification before proceeding.
- B. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Design Professional for a decision before proceeding.

1.6 INFORMATIONAL SUBMITTALS

- A. **Contractor's Quality-Control Plan:** For quality-assurance and quality-control activities and responsibilities.
- B. **Qualification Data:** For Contractor's quality-control personnel.
- C. **Contractor's Statement of Responsibility:** When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- D. **Testing Agency Qualifications:** For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. **Schedule of Tests and Inspections:** Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- F. **Reports:** Prepare and submit certified written reports and documents as specified.

- G. Permits, Licenses, and Certificates: For Engineer's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed. Submit in format acceptable to Design Professional. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Engineer's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
 - 3. Engineer-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Design Professional has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
 2. Project title and number.
 3. Name, address, telephone number, and email address of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement of whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.

3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.9 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.
 1. Requirements of authorities having jurisdiction supersede requirements for specialists.
- G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and

perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following Contractor's responsibilities, including the following:
1. Provide test specimens representative of proposed products and construction.
 2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 4. When testing is complete, remove test specimens and test assemblies; do not reuse products on Project.
 5. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Design Professional with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups of size indicated.
 2. Build mockups in location indicated or, if not indicated, as directed by Design Professional.
 3. Notify Design Professional seven days in advance of dates and times when mockups will be constructed.
 4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 6. Obtain Design Professional's approval of mockups before starting corresponding Work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 7. Promptly correct unsatisfactory conditions noted by Design Professional's preliminary review, to the satisfaction of the Design Professional, before completion of final mockup.
 8. Approval of mockups by the Design Professional does not constitute approval of deviations from the Contract Documents contained in mockups unless Design Professional specifically approves such deviations in writing.
 9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

10. Demolish and remove mockups when directed unless otherwise indicated.

1.10 QUALITY CONTROL

- A. Engineer Responsibilities: Where quality-control services are indicated as Engineer's responsibility, Engineer will engage a qualified testing agency to perform these services.
 - 1. Engineer will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Engineer are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor will not employ same entity engaged by Engineer, unless agreed to in writing by Engineer.
 - 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
 - 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Design Professional and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Design Professional and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Engineer-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Engineer, Design Professional, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Engineer will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Engineer as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Design Professional and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Design Professional with copy to Contractor and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
 6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Design Professional.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Design Professional's and authorities' having jurisdiction reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 01420

REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Design Professional's action on Contractor's submittals, applications, and requests, "approved" is limited to Design Professional's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Design Professional. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
 - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; (See FGIA).
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.plib.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).

31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASSP - American Society of Safety Professionals (The); www.assp.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AVIXA - Audiovisual and Integrated Experience Association; (Formerly: Infocomm International); www.avixa.org.
38. AWEA - American Wind Energy Association; www.awea.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWPAA - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
50. CDA - Copper Development Association; www.copper.org.
51. CE - Conformite Europeenne; www.ec.europa.eu/growth/single-market/ce-marking.
52. CEA - Canadian Electricity Association; www.electricity.ca.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.

58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.compositepanel.org.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csa-group.org.
65. CSI - Cast Stone Institute; www.caststone.org.
66. CSI - Construction Specifications Institute (The); www.csiresources.org.
67. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
68. CTA - Consumer Technology Association; www.cta.tech.
69. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.coolingtechnology.org.
70. CWC - Composite Wood Council; (See CPA).
71. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
72. DHA - Decorative Hardwoods Association; (Formerly: Hardwood Plywood & Veneer Association); www.decorativehardwoods.org.
73. DHI - Door and Hardware Institute; www.dhi.org.
74. ECA - Electronic Components Association; (See ECIA).
75. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
76. ECIA - Electronic Components Industry Association; www.ecianow.org.
77. EIA - Electronic Industries Alliance; (See TIA).
78. EIMA - EIFS Industry Members Association; www.eima.com.
79. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
80. EOS/ESD Association; (Electrostatic Discharge Association); www.esda.org.
81. ESTA - Entertainment Services and Technology Association; (See PLASA).
82. ETL - Intertek (See Intertek); www.intertek.com.
83. EVO - Efficiency Valuation Organization; www.evo-world.org.
84. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
85. FGIA - Fenestration and Glazing Industry Alliance; <https://fgiaonline.org>.
86. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.

87. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
88. FM Approvals - FM Approvals LLC; www.fmapprovals.com.
89. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
90. FRSA - Florida Roofing, Sheet Metal Contractors Association, Inc.; www.floridarooft.com.
91. FSA - Fluid Sealing Association; www.fluidsealing.com.
92. FSC - Forest Stewardship Council U.S.; www.fscus.org.
93. GA - Gypsum Association; www.gypsum.org.
94. GANA - Glass Association of North America; (See NGA).
95. GS - Green Seal; www.greenseal.org.
96. HI - Hydraulic Institute; www.pumps.org.
97. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
98. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
99. HPVA - Hardwood Plywood & Veneer Association; (See DHA).
100. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
101. IAS - International Accreditation Service; www.iasonline.org.
102. ICBO - International Conference of Building Officials; (See ICC).
103. ICC - International Code Council; www.iccsafe.org.
104. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
105. ICPA - International Cast Polymer Association; www.theicpa.com.
106. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
107. IEC - International Electrotechnical Commission; www.iec.ch.
108. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
109. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
110. IESNA - Illuminating Engineering Society of North America; (See IES).
111. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
112. IGMA - Insulating Glass Manufacturers Alliance; (See FGIA).
113. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
114. II - Infocomm International; (See AVIXA).
115. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.

116. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
117. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
118. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
119. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
120. ISO - International Organization for Standardization; www.iso.org.
121. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
122. ITU - International Telecommunication Union; www.itu.int.
123. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
124. LMA - Laminating Materials Association; (See CPA).
125. LPI - Lightning Protection Institute; www.lightning.org.
126. MBMA - Metal Building Manufacturers Association; www.mbma.com.
127. MCA - Metal Construction Association; www.metalconstruction.org.
128. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
129. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
130. MHI - Material Handling Industry; www.mhi.org.
131. MIA - Marble Institute of America; (See NSI).
132. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
133. MPI - Master Painters Institute; www.paintinfo.com.
134. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
135. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
136. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
137. NADCA - National Air Duct Cleaners Association; www.nadca.com.
138. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
139. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
140. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
141. NBI - New Buildings Institute; www.newbuildings.org.
142. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.

143. NCMA - National Concrete Masonry Association; www.ncma.org.
144. NEBB - National Environmental Balancing Bureau; www.nebb.org.
145. NECA - National Electrical Contractors Association; www.necanet.org.
146. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
147. NEMA - National Electrical Manufacturers Association; www.nema.org.
148. NETA - InterNational Electrical Testing Association; www.netaworld.org.
149. NFHS - National Federation of State High School Associations; www.nfhs.org.
150. NFPA - National Fire Protection Association; www.nfpa.org.
151. NFPA - NFPA International; (See NFPA).
152. NFRC - National Fenestration Rating Council; www.nfrc.org.
153. NGA - National Glass Association (The); (Formerly: Glass Association of North America); www.glass.org.
154. NHLA - National Hardwood Lumber Association; www.nhla.com.
155. NLGA - National Lumber Grades Authority; www.nlga.org.
156. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
157. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
158. NRCA - National Roofing Contractors Association; www.nrca.net.
159. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
160. NSF - NSF International; www.nsf.org.
161. NSI - National Stone Institute; (Formerly: Marble Institute of America); www.naturalstoneinstitute.org.
162. NSPE - National Society of Professional Engineers; www.nspe.org.
163. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
164. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
165. NWFA - National Wood Flooring Association; www.nwfa.org.
166. NWRA - National Waste & Recycling Association; www.wasterecycling.org.
167. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
168. PDI - Plumbing & Drainage Institute; www.pdionline.org.
169. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
170. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
171. RFCI - Resilient Floor Covering Institute; www.rfci.com.

172. RIS - Redwood Inspection Service; www.redwoodinspection.com.
173. SAE - SAE International; www.sae.org.
174. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
175. SDI - Steel Deck Institute; www.sdi.org.
176. SDI - Steel Door Institute; www.steeldoor.org.
177. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
178. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
179. SIA - Security Industry Association; www.siaonline.org.
180. SJI - Steel Joist Institute; www.steeljoist.org.
181. SMA - Screen Manufacturers Association; www.smainfo.org.
182. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
183. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
184. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
185. SPIB - Southern Pine Inspection Bureau; www.spib.org.
186. SPRI - Single Ply Roofing Industry; www.spri.org.
187. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
188. SSINA - Specialty Steel Industry of North America; www.ssina.com.
189. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
190. STI - Steel Tank Institute; www.steeltank.com.
191. SWI - Steel Window Institute; www.steelwindows.com.
192. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
193. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
194. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
195. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
196. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
197. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
198. TMS - The Masonry Society; www.masonrysociety.org.
199. TPI - Truss Plate Institute; www.tpinst.org.

200. TPI - Turfgrass Producers International; www.turfgrasssod.org.
 201. TRI - Tile Roofing Institute; www.tilerroofing.org.
 202. UL - Underwriters Laboratories Inc.; www.ul.com.
 203. UL LLC - UL LLC; www.ul.com.
 204. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
 205. USAV - USA Volleyball; www.usavolleyball.org.
 206. USGBC - U.S. Green Building Council; www.usgbc.org.
 207. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
 208. WA - Wallcoverings Association; www.wallcoverings.org.
 209. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
 210. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
 211. WDMA - Window & Door Manufacturers Association; www.wdma.com.
 212. WI - Woodwork Institute; www.wicnet.org.
 213. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
 214. WWPA - Western Wood Products Association; www.wwpa.org.
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
 2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 3. ICC - International Code Council; www.iccsafe.org.
 4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
 5. OBC - Ohio Building Code
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
1. COE - Army Corps of Engineers; www.usace.army.mil.
 2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
 3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 4. DOE - Department of Energy; www.energy.gov.
 5. EPA - Environmental Protection Agency; www.epa.gov.

6. FAA - Federal Aviation Administration; www.faa.gov.
7. FG - Federal Government Publications; www.gpo.gov/fdsys.
8. GSA - General Services Administration; www.gsa.gov.
9. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
10. OSHA - Occupational Safety & Health Administration; www.osha.gov.
11. USPS - United States Postal Service; www.usps.com.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities shall 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, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Engineer will pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Engineer will pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Engineer will pay electric-power-service use charges for electricity used by all entities for construction operations.
- E. Water and Sewer Service from Existing System: Water from Engineer's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- F. Electric Power Service from Existing System: Electric power from Engineer's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.
- C. Project Identification and Temporary Signs: Not required. Contractor may display their own Project Identification Sign at Contractor's cost and as approved by the Engineer.
- D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
 - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
 - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
 - 3. Indicate methods to be used to avoid trapping water in finished work.
- F. 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. Location 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.
- G. 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 Owner. Include the following:
 - 1. Methods used to meet the goals and requirements of 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 Owner.
 - 6. Indicate locations of sensitive equipment areas or other areas requiring special attention as identified by Owner. Indicate means for complying with Owner's requirements.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Engineer's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide concrete bases for supporting posts.
- B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.
- C. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.
- D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Design Professional, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.

3. Drinking water and private toilet.
 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Engineer authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 3. Permanent HVAC System: If Engineer authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Engineer's property.

3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 - 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 - 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Engineer, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Water Service: Connect to Engineer's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Engineer. At Substantial Completion, restore these facilities to condition existing before initial use.
- E. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Use of Permanent Toilets: Use of Engineer's existing or new toilet facilities will not be permitted.
- F. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- G. Electric Power Service: Connect to Engineer's existing electric power service. Maintain equipment in a condition acceptable to Engineer.
- H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 1. Install electric power service underground unless otherwise indicated.
 2. Connect temporary service to Engineer's existing power source, as directed by Engineer.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- J. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel.
 1. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Design Professional's office.
 - f. Engineers' offices.
 - g. Engineer's office.
 - h. Principal subcontractors' field and home offices.
- K. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Design Professional and Engineer.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
 1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
 2. Maintain support facilities until Design Professional schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Engineer.

- B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- C. Parking: Use designated areas of Engineer's existing parking areas for construction personnel.
- D. Storage and Staging: Use designated areas of Project site for storage and staging needs.
- E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - 3. Maintain and touch up signs, so they are legible at all times.
- F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- H. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
 - 1. Do not load elevators beyond their rated weight capacity.
 - 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work, so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- I. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas, so no evidence remains of correction work.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
 - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property Engineer to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- D. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- F. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.
- G. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.
 - 1. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
 - 2. Paint and maintain appearance of walkway for duration of the Work.
- H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- I. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard, with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Insulate partitions to control noise transmission to occupied areas.
3. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
4. Protect air-handling equipment.
5. Provide walk-off mats at each entrance through temporary partition.

J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in 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.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.

5. Do not install material that is wet.
 6. Discard and replace stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Design Professional.
 - c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 1. Materials and facilities that constitute temporary facilities are property of Contractor. Engineer reserves right to take possession of Project identification signs.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove

soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 01560

TEMPORARY CONTROLS AND REGULATORY REQUIREMENTS FOR ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.01 GENERAL

- A. Each CONTRACTOR shall provide and maintain methods, equipment, and temporary construction, as necessary to provide controls over environmental conditions at the construction site and adjacent areas. Remove physical evidence of temporary facilities at completion of Work.
- B. Each CONTRACTOR shall adhere to all federal, state, and local laws, permits, and regulations concerning environmental pollution and its control and all other controls required by this Section and the Contract Documents.
- C. CONTRACTOR shall cease operations determined by ENGINEER to be in noncompliance with the requirements of this Section. The CONTRACTOR shall make every effort to take corrective action promptly. The ENGINEER shall issue an order to stop all or part of the Work should the CONTRACTOR fail to comply promptly. No part of time loss due to such stoppage shall be used for claims for extension of time and additional monetary compensation.
- D. Disposals: Construction wastes, excess excavated material, unsalvageable materials, devices, and equipment not required to be turned over to OWNER shall not be allowed to remain on construction site except for clean fill dirt. Construction waste to be disposed of shall include, but is not limited to, wood, wallboard, support steel, packing, roofings, floorings, oils, pesticides, herbicides, paints, thinners, cleaners, etc. Comply with the disposal requirements stated in Section 01710, Cleaning.

1.02 NOISE CONTROL

- A. CONTRACTOR's vehicles and equipment shall be operated and maintained to minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and shall not exceed maximum permitted levels established by local codes, ordinances, standards and regulations. In no case will noise levels be permitted which interfere with the work of the OWNER or others.
- B. Motorized equipment shall be equipped with intake silencers and mufflers.

1.03 DUST CONTROL

- A. Each CONTRACTOR shall maintain work areas free from dust which would contribute to air pollution or otherwise be objectionable or a nuisance. Approved temporary methods of stabilization consisting of water sprinkling or similar methods will be permitted to control dust. Sprinkling, to be approved, must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the CONTRACTOR must have sufficient competent equipment on the job to accomplish this task. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.

- 1. Do not use calcium chloride on paved surfaces.

1.04 PEST AND RODENT CONTROL

- A. Each prime CONTRACTOR shall provide rodent and pest control as necessary to prevent infestation of construction or storage area.
 - 1. Employ methods and use materials which will not adversely affect conditions at the site or on adjoining properties.
 - 2. Comply with all Ohio EPA and federal regulations.

1.05 POLLUTION CONTROL

- A. Provide methods, means and facilities required to prevent pollution of soil, groundwater, surface water or atmosphere with fuels, oils, bitumens, calcium chloride, construction wastes, and other harmful substances from construction operations.
 - 1. Pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; or unfavorably affect other species of importance.
- B. Spills, Discharges and Releases:
 - 1. Provide necessary equipment and personnel and perform emergency measures required to contain any spillages, discharges and releases and to remove contaminated soils or liquids.
 - 2. Excavate and dispose of any contaminated earth offsite and replace with suitable compacted fill and topsoil.
 - 3. Take all action necessary to prevent harmful substances from entering surface waters or groundwater. Prevent release of soil, sediment, wastes, effluents, chemicals, and other such substances adjacent to and in streams, sanitary sewers and storm sewers.
 - 4. CONTRACTOR shall report all fuel/chemical spills, discharges and releases that occur to the appropriate regulatory agency regardless of who is responsible. The spills, discharges and releases shall also be reported to the ENGINEER with the report made immediately following awareness of the incident.
 - 5. The CONTRACTOR shall clean up all spills, discharges and releases caused by the CONTRACTOR's negligence of faulty equipment. The cleanup methods shall be as required by or acceptable to the ENGINEER.
 - 6. The CONTRACTOR shall reimburse the OWNER for all materials and assistance provided by the OWNER and used in containment or cleanup of those spills, discharges and releases caused by the CONTRACTOR's negligence or faulty equipment.
- C. Provide systems for control of atmospheric pollutants.
 - 1. Prevent toxic concentrations of chemicals.
 - 2. Prevent harmful dispersal of pollutants into the atmosphere.
- D. Burning. No open burning of any construction waste and/or unsalvageable materials shall be allowed.

- E. Litter. Litter shall be controlled and containerized at all times. Care will be exercised to ensure that no litter is lost from any vehicle while in transit to and from the construction site.
- F. All CONTRACTOR's equipment used during construction shall conform to all current federal, state and local laws and regulations.

1.06 EROSION CONTROL

- A. CONTRACTOR shall comply with all requirements of local, state and federal storm water regulations.
- B. CONTRACTOR shall comply with all requirements of Ohio EPA Permit number OHC000004 - "Authorization for Storm Water Discharges Associated with Construction Activity under the National Pollutant Discharge Elimination System".
- C. CONTRACTOR shall obtain permit coverage from the Ohio Environmental Protection Agency under permit OHC000004. CONTRACTOR shall submit to the Ohio EPA a Notice of Intent (NOI), a site map (8 1/2" x 11"), a permit fee (expected fee between \$200 and \$500), prepare a Storm Water Pollution Prevention Plan, and perform and submit all other items necessary to achieve coverage under the permit. See Miscellaneous Forms for the NOI form and instructions.
- D. CONTRACTOR shall avoid, to the greatest extent possible and in accordance with the Contract Documents and the Storm Water Pollution Prevention Plan, disturbance to the stream bank and streambed and prevent erosion and sediment runoff.
- E. Each CONTRACTOR shall plan and execute construction and earth work by methods to control surface water drainage from the entire construction site including from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation in compliance with the approved Storm Water Pollution Prevention Plan and as follows:
 - 1. Reduce by the greatest extent practicable the area and duration of exposure of readily erodible soils.
 - 2. Protect the soils by use of temporary vegetation, or seeding and mulch, or by accelerating the establishment of permanent vegetation. Complete and protect segments of work as rapidly as is consistent with approved construction schedules.
 - 3. Provide temporary measures such as berms, dikes, erosion control fences, silt barriers, geotextiles, drains, etc. to protect storm sewers, streams, and all water conveying systems from water-borne sediment and to control surface water drainage.
 - 4. Control fill, grading and ditching to direct surface water drainage away from excavations, pits, tunnels and other construction areas; and to direct drainage to proper runoff courses so as to prevent any erosion, damage or nuisance.
 - 5. Trap sediment resulting from the construction site and control disposal of surface water drainage.
 - 6. Provide temporary measures for the control of erosion in the event construction operations are suspended for any appreciable length of time.
 - 7. Provide protection against discharge of pollutants such as chemicals, fuel, lubricants, sewage, etc. into any stream, sewer and water drainage course.

8. For slopes greater than 2 to 1 (two feet of horizontal distance to one foot of vertical rise), provide water diversion berms, sod or jute or excelsior blankets at a minimum.
- F. Provide, operate and maintain equipment and facilities of adequate size to control surface water drainage.
- G. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas and in conformance with all environmental requirements.
- H. Construct fills and waste areas by selective placement to eliminate surface silts or clays which will erode.
- I. Periodically inspect earthwork to detect any evidence of the start of erosion and apply corrective measures as required to control erosion.

1.07 STREAM CROSSING/ RIPARIAN ZONE CONSTRUCTION

- A. CONTRACTOR shall take all action necessary to minimize damage to vegetation and trees in the riparian zone adjacent to streams.
 1. Definitions: The latest definition of similar terms or concepts by the Ohio Environmental Protection Agency shall supersede the definitions following:
 - a. Riparian zone is defined to extend a minimum distance of two and one-half times the stream width, from top of bank to top of bank, on each side of the stream.
 - b. Streams are defined as any water course draining an area equal to one half square mile or greater.
- B. General CONTRACTOR shall prepare a detailed work plan including but not limited to the following information:
 1. Locations of haul roads, stockpile sites, and staging areas.
 2. Protection of existing vegetation.
 3. Types of erosion control measures to be employed.
 4. Places where erosion control measures will be used.
 5. Methods to be used for stream crossing work.
 6. Types of temporary bridges, culverts, etc. proposed to be used for haul roads crossing streams.
 7. Restoration of disturbed areas in stages to match work progress and minimize impacts.
- C. General CONTRACTOR shall present the work plan in draft form at the pre-construction conference. Final work plan incorporating review comments shall be submitted to ENGINEER prior to the start of construction in impacted areas.
- D. As directed by ENGINEER, General CONTRACTOR shall prepare and submit a videotape record of pre-construction condition of stream crossing and riparian zone construction areas.

- E. Each CONTRACTOR's practices during construction in stream crossings and riparian zones shall include but not be limited to the following:
1. Limit clearing and grubbing activities within easements to only that needed for actual construction.
 2. Perform clearing and grubbing work (and site restoration) in stages to limit soil exposure and sediment runoff.
 3. Properly install and maintain erosion control devices along the limits of construction and wherever required by work plan. Maintain erosion control devices until permanent vegetative cover has been established.
 4. Place all dredged material at an upland site in such a way that sediment runoff to the waterway is controlled and minimized.
 5. Restrict any stream crossing work to low flow periods.
 6. Preserve all streambank vegetation at crossing sites, except that necessary for actual excavation and equipment passage, to help maintain bank stability. Protect as many trees as possible from construction activity. Do not stockpile any material within tree driplines.
 7. Ensure bank stability at all times, including, but not limited to, placement of riprap or bank seeding.
 8. Divert stream flow around the work site during stream crossing work to minimize bank erosion.
 - a. Flow Diversion: Divert flows so as to prevent discharge of any spoil materials, sediment, construction debris and excavated materials into the stream waters.
 9. Employ extreme care throughout the course of work to avoid the creation of unnecessary sediment or debris in the water which may degrade water quality or adversely affect aquatic life outside the work area.
 10. Discharge any dewatering flows in such a manner so as to avoid causing soil erosion or stream siltation.
 - a. Direct discharge of dewatering flows is strictly prohibited. Sediment shall be removed from dewatering flows by use of siltation basins or filters.
 - b. After sediment has been removed, dewatering flows can be discharged to stable sites such as streams or storm sewers, however, they shall not be discharged to exposed soils, stream banks, or any other site where flows could cause erosion.
 11. Repair immediately any damages to the immediate environment caused by construction or hauling equipment.
 12. Do not alter natural stream courses.
- F. The completed stream crossing shall not impede the flow of water or create an impoundment of water upstream except as allowed by appropriate permits.

- G. Indiscriminate, arbitrary or capricious operation of any equipment in a stream corridor, wetland, or surface water is strictly prohibited.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 2. Section 014200 "References" for applicable industry standards for products specified.
 - 3. Section 01770 "Closeout Procedures" for submitting warranties.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."
- F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 1. If dispute arise between contractors over concurrently selectable but incompatible products, Design Professional will determine which product shall be used.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
 2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

- a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.5 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.
- C. Storage:
1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
 2. Store products to allow for inspection and measurement of quantity or counting of units.
 3. Store materials in a manner that will not endanger Project structure.
 4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
 5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Engineer or endorsed by manufacturer to Engineer.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Engineer and issued in the name of the Engineer or endorsed by manufacturer to Engineer.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Engineer reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Design Professional will make selection.

5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Design Professional in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Design Professional, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
 - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.

- a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require the phrase "match Design Professional's sample," provide a product that complies with requirements and matches Design Professional's sample. Design Professional's decision will be final on whether a proposed product matches.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Design Professional from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Design Professional will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Design Professional will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Design Professional may return requests without action, except to record noncompliance with the following requirements:
 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects, with project names and addresses and names and addresses of Design Professionals and Engineers, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 01710

CLEANING

PART 1 GENERAL

1.01 GENERAL

- A. Each prime CONTRACTOR shall execute cleaning during progress of the Work, at completion of the Work, and as required by the General Conditions.
- B. Requirements of Regulatory Agencies:
 - 1. In addition to the requirements herein, maintain the cleanliness of the Project site, the construction area, the surrounding premises, all temporary storage yards and staging areas so as to comply with federal, state, and local fire and safety laws, ordinances, codes and regulations.
 - 2. Comply with all federal, state and local anti-pollution laws, ordinances, codes and regulations when disposing of any material, waste materials, debris and rubbish.
- C. Waste Disposal:
 - 1. Dispose of all waste materials, surplus materials, debris and rubbish off the project site.
 - 2. Do not burn or bury rubbish and waste materials on the project site.
 - 3. Do not dispose of volatile compounds or hazardous wastes such as fuels, cleaning agents, mineral spirits, oil, paint thinner, etc. in storm drains, sanitary sewers, streams, waterways and any other conveyance system.
 - 4. Do not discharge wastes into streams or waterways.
 - 5. Do not discharge wastes into plant drains or process units. In no case can wastes be allowed to enter County operated systems.
- D. Cleaning Materials:
 - 1. Use only cleaning materials recommended by manufacturer of surface to be cleaned.
 - 2. Use each type of cleaning product on only those surfaces recommended by the cleaning product manufacturer.
 - 3. Use only materials which will not create hazards to health or property.

1.02 SCHEDULING

- A. Scheduling of Cleaning and Disposal Operations:
 - 1. Schedule such operations so that dust, wash water or other contaminants generated during such operations do not damage or mar painted or finished surfaces.
 - 2. Schedule such operations to prevent accumulation of dust, dirt, debris, rubbish and waste materials on or within the Work or on the premises surrounding the Work.

B. Cleaning and disposal operations shall be performed once a day at a minimum and as required to accomplish the requirements of this Section:

1. During Construction:

- a. Keep the Project site, the construction area, the surrounding premises, all temporary storage yards and staging areas and surrounding premises free of accumulations of dirt, dust, waste materials, debris and rubbish.
- b. Keep dust generating areas wetted down. The requirements for dust control is further defined in Section 01560.
- c. Provide suitable containers for storage of waste materials, debris and rubbish until time of disposal.
- d. Dispose of waste, debris and rubbish off site at legal disposal areas.

2. When Project is Completed:

- a. Remove and dispose of all excess or waste materials, debris, rubbish, and temporary facilities from the site, structures and all facilities.
- b. Remove spatter, grease, stains, fingerprints, dirt, dust, labels, tags, packing materials and other foreign items or substances from interior and exterior surfaces, equipment, signs and lettering.
- c. Repair, patch and touch up chipped, scratched, dented or otherwise marred surfaces to match specified finish.
- d. Remove paint, clean and restore all equipment and material nameplates, labels and other identification markings.
- e. Wash and shine mirrors, glazing and polished surfaces.
- f. Clean all floors, slabs, pavements, and ground surfaces.
- g. Maintain cleaning until acceptance and occupation by OWNER.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01720

RECORD DOCUMENTS

PART 1 GENERAL

1.01 GENERAL

- A. CONTRACTOR shall maintain and provide record documents as specified in paragraph 7.11 of the General Conditions and herein, except where otherwise specified or modified in Divisions 2-16. The General CONTRACTOR shall have the responsibility of ensuring that each of the other prime CONTRACTORS maintains the record documents specified herein.
- B. Maintenance of Documents:
 - 1. Maintain in each prime CONTRACTOR's field office in clean, dry, legible condition complete sets of the following: Drawings, Specifications, Addenda, approved Shop Drawings, Samples, photographs, Change Orders, other modifications of Contract Documents, test records, survey data, Field Orders, and all other documents pertinent to CONTRACTOR's Work.
 - 2. Provide files and racks for proper storage and easy access. File in accordance with filing format of Construction Specification Institute (CSI), unless otherwise approved by the ENGINEER.
 - 3. Make documents available at all times for inspection by the ENGINEER, and OWNER.
 - 4. Record Documents shall not be used for any other purpose and shall not be removed from the CONTRACTOR's office without ENGINEER's approval.
- C. Marking System: Provide colored pencils or felt tipped pens for marking changes, revisions, additions and deletions, to the record set of Drawings.
 - 1. Use following color code for all structures and systems except underground utilities, unless otherwise approved by the ENGINEER.
 - a. Process and Mechanical: Red.
 - b. Architectural: Blue.
 - c. Structural: Purple.
 - d. Plumbing: Brown.
 - e. HVAC: Green.
 - f. Electrical: Orange.
 - g. Other Printed Notations: Black.
 - 2. For underground utilities use the Montgomery County Standard Underground Protection Service color coding system.

Sanitary Sewer - Green

Phone - Orange

Storm Sewer - Green

CATV - Orange

Electric - Red

Water - Blue

Gas - Yellow

D. Recording

1. Label each document "PROJECT RECORD" in 2-inch high printed letters.
2. Keep record documents current.
3. Do not permanently conceal any Work until required information has been recorded.
4. CONTRACTOR shall utilize dimensional measurements, state plane coordinates, and elevations to provide survey accurate data for all sanitary sewer and water appurtenances and facilities installed for this project. This information shall be incorporated into the as-built drawings of the Work. Any point that will be covered, such as lateral wyes/tees, ends of casings, and deflection points for water mains, shall be located prior to being covered by three horizontal reference points approximately 120 degrees apart. The points shall be nails, stakes, or other fixed points that will enable the reestablishment of the horizontal location of the point after the item is covered. Elevations of each point shall be determined prior to covering the point.

1.02 DRAWINGS

A. Comply with the Montgomery County Environmental Services Rules and Regulations and legibly mark to record actual construction including but not limited to:

1. Depths of various elements of foundation/construction in relation to NAD 83 datum.
2. Horizontal location of all underground utilities and appurtenances referenced to permanent surface improvements.
3. Horizontal locations referenced to the State Plane Coordinate System.
4. Prepare additional drawings as necessary.
5. Information to be recorded shall include but not be limited to:
6. Physical location of manholes, bends, hydrants, and valves by horizontal control to two permanent surface objects and by State Plane Coordinates,
7. Angles between lines,
8. Lengths of spans, and
9. Elevations of all pipe inverts and tops of manholes.
10. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
11. Field changes of dimensions and details.
12. Changes made by Amendment or Field Order.

13. Material description of each pipe installed.
14. Details not on original Drawings.
15. All sanitary manholes, lampholes and water valves shall be located with a minimum of two (2) horizontal dimensions. The two (2) dimensions shall not be on the same line to the appurtenance or on the same line on either side of the appurtenance. The angles between dimension lines should be between 20 and 160 degrees.
16. All record location dimensions shall be measured in feet and tenths of a foot and shall not exceed 100 feet in length.
 - a. The character height of numbers shall be between 0.125 inches minimum and 0.5 inches maximum.
 - b. Dimension lines shall be shown on each drawing except where they would add substantial confusion in interpreting the drawing. In those cases, a detail shall be included on the same plan sheet. The detail shall include the dimensions and an arrow pointing to the area of the drawing represented by the detail.
 - c. Dimensions shall be from centerline to centerline of each object except for house corners and catch basins (see paragraph 6 below).
17. Dimensions shall be level distances unless noted under special conditions.
18. The following shall be required on all record drawings:
 - a. Measured distance between valves within each intersection and at each tee and cross. These dimensions shall be in addition to the two (2) required dimension locations.
 - b. Measured distance between fire hydrants and fire hydrant valves.
 - c. Measured distances between sanitary manholes, and between a sanitary sewer and a lamphole, shall be shown on the plan. Length of span, grade size of pipe, pipe material and invert elevations shall be shown in the profile.
 - d. The plan view of pipe length and location on the plan and profile drawing shall be changed for any constructed span length or horizontal location that differs more than five (5) feet from the design. The span length on both the plan and profile shall be labeled with the constructed length.
 - e. The profile view on the plan and profile drawing shall be changed for any constructed sanitary or storm sewer invert elevation that differs more than 0.5 feet from the design elevation. The invert elevations shall be labeled with the constructed invert elevations.
 - f. The plan view of a constructed water main shall be changed for any horizontal location that differs more than five (5) feet from the design location.
19. The following is a list of objects that are acceptable for as-built dimension references, in order of preference:
 - a. Fire Hydrant.

- b. Curb. All curb dimensions shall be to the back of the curb and shall not be to any curb or extended curb lines with a radius.
- c. Catch basins. Dimensions shall be to the nearest corner of the street edge on the street side. The street name and reference corner on the catch basin shall be indicated.
- d. Sanitary Manhole may be used for valve locations.
- e. Permanent Utility Pole (pole number shall be included).
- f. House Corner. The house street address shall be indicated when a dimension to a house corner is used. Show the entire outline of the house and designate the reference corner for the measured dimension.
- g. Corner of a drive. The house street address shall be indicated when a dimension to a driveway corner is used.

20. MCES will possess copies of all vendor and CONTRACTOR Electronic drawing files at the end of the project. The Electronic drawing files shall be provided in AutoCAD® 2018. This includes but is not limited to: PLC control panels, motor control centers, motor starters, switchgear, automatic and manual transfer switches, panels and switchboards, mobile and permanent generators, and any other equipment provided for this project.

1.03 SPECIFICATIONS AND ADDENDA

A. Legibly mark up each Section to record:

- 1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
- 2. Changes made by Amendment or Field Order.
- 3. Other matters not originally specified.

1.04 DATABASE

- A. See Section S-01050, Field Engineering/Surveying for additional requirements related to database submission.

1.05 GRADE CERTIFICATION

- A. Grade Certification: Grade certifications shall be prepared, signed, dated and sealed by a State of Ohio Registered Surveyor or Engineer. The certifications shall be in a tabular format. Rows shall be manhole numbers. Columns shall include:

- 1. Upstream Manhole Number
- 2. Inlet Pipe diameter (inches)
- 3. Invert elevation (feet)
- 4. Elevation difference (feet)
- 5. Span length (feet)

6. Grade (%)
7. Top of Casting elevation (feet)
8. Northing (state plane coordinate)
9. Easting (state plane coordinate)
10. Comments

PART 2 PRODUCTS

2.01 SUBMITTAL

- A. Upon Substantial Completion of the Work, deliver Record Documents to the ENGINEER. Final payment will not be made until satisfactory Record Documents are received by the ENGINEER. Record Documents shall include the following:
 1. One marked paper copy of the design drawings with as-built information.
 2. One (1) original signed copy of the grade certification.
 3. One database table as specified in Section S-01050.
- B. Accompany submittal with transmittal letter containing:
 1. Date.
 2. Project title and number.
 3. CONTRACTOR's name and address.
 4. Title and number of each record document.
 5. Certification that each document as submitted is complete and accurate.
 6. Signature of CONTRACTOR, or his authorized representative.

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01730

EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Engineer's portion of the Work.
6. Coordination of Engineer-installed products.
7. Progress cleaning.
8. Starting and adjusting.
9. Protection of installed construction.
10. Correction of the Work.

- B. Related Requirements:

1. Section 01100 "Summary" for coordination of Engineer-performed work , Engineer's separate contracts, and limits on use of Project site.
2. Section 01771 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Engineer-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
3. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
4. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Conduct conference at Project site.
1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Design Professional of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
 - a. Contractor's superintendent.
 - b. Trade supervisor responsible for cutting operations.
 - c. Trade supervisor(s) responsible for patching of each type of substrate.
 - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.
 2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 INFORMATIONAL SUBMITTALS

- A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 3. Products: List products to be used for patching and firms or entities that will perform patching work.
 4. Dates: Indicate when cutting and patching will be performed.
 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.5 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: Refer to Section 01400 "Quality Requirements."

- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Design Professional of locations and details of cutting and await directions from Design Professional before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Sprayed fire-resistive material.
 - d. Equipment supports.
 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Design Professional's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Design Professional for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.
- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Engineer that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Design Professional in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Design Professional promptly.
- B. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- C. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Design Professional.

3.4 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb, and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Design Professional. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Design Professional.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Design Professional. Fit exposed connections together to form hairline joints.

3.5 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 01100 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Design Professional. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

- b. Restore damaged pipe covering to its original condition.
- 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
- 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 COORDINATION OF ENGINEER'S PORTION OF THE WORK

- A. Site Access: Provide access to Project site for Engineer's construction personnel and Engineer's separate contractors.
 - 1. Provide temporary facilities required for Engineer-furnished, Engineer-installed products.
 - 2. Refer to Section 01100 "Summary" for other requirements for Engineer-furnished, Engineer-installed products.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Engineer's construction personnel and Engineer's separate contractors.
 - 1. Construction Schedule: Inform Engineer of Contractor's preferred construction schedule for Engineer's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Engineer if changes to schedule are required due to differences in actual construction progress.
 - 2. Preinstallation Conferences: Include Engineer's construction personnel and Engineer's separate contractors at preinstallation conferences covering portions of the Work that are to receive Engineer's work. Attend preinstallation conferences conducted by Engineer's construction personnel if portions of the Work depend on Engineer's construction.

3.7 PROGRESS CLEANING

- A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Restore permanent facilities used during construction to their specified condition.
- D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 01739

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Ohio Revised Code (ORC) Chapter 3745-273 - Management Standards for Universal Waste.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous construction waste.
 - 2. Recycling nonhazardous construction waste.
 - 3. Disposing of nonhazardous construction waste.
 - 4. Disposing of Universal Waste.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Universal Waste: Specific building materials resulting from demolition or selective demolition operations including: Batteries, Mercury-Containing Equipment and Lamps.
- D. Disposal: Removal off-site of demolition and construction waste and subsequent sale of, recycling of, reuse of, or depositing in landfill or incinerator acceptable to authorities having jurisdiction.
- E. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- F. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.
- B. Proper Universal Waste handling, transporting and processing meeting the requirements of these specifications and the ORC will protect the environment from mercury and other toxic heavy metals that may pose risks to human health and the environment.

1.5 INFORMATIONAL SUBMITTALS

- A. Recycling and Processing Facility Records: Indicate receipt and acceptance of Recyclable and Universal Waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- B. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- C. Qualification Data: For refrigerant recovery technician.
- D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.7 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers. All recyclable plastic containers, glass bottles and cans shall be collected from construction site by contractor and placed in Engineer's recycling bins.
- B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 - 1. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste from Engineer's property and transport to recycling receiver or processor.

3.3 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.

3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. All metal and wiring shall be separated from construction debris and recycled off site by contractor.
- C. Wood Materials:
1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- D. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

3.4 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Do not Use Engineers dumpsters for disposal unless direct by the Engineer's Project Manager.
 4. Engineer reserves the right to salvage any item deemed of value to the University to re-purpose.
- B. Burning: Do not burn waste materials.
- C. Batteries:
1. Remove Lead-Acid batteries from fixtures or appliances and place in a closed, structurally sound container compatible with the contents of the battery.
 2. Containers shall prevent any universal waste components from leaking or spilling into the environment.
 3. Provide labeling with the phrase "Universal Waste – Batteries".
- D. Mercury-Containing Equipment:
1. Remove Lamps, light fixture ballasts and thermostats from ceilings and walls and place in closed, structurally sound containers compatible with the contents of the mercury-containing device.
 2. Containers shall prevent any universal waste components from leaking or spilling into the environment.

3. Provide separate containers for each type of mercury-containing device.
 4. Provide labeling using the following phrases:
 - a. “Universal Waste – Lamps”
 - b. “Universal Waste – Mercury Ballasts”
 - c. “Universal Waste – Mercury Thermostats”
- E. Prepare Cleanup Plan for broken lamps and spilled mercury.
1. Do not use a vacuum cleaner to collect broken lamps or mercury.
 2. Turn off air handling equipment.
 3. Scoop glass, powder materials and mercury into a separate container.
 4. Collect remaining debris with sticky side of duct tape.
 5. Wipe clean with disposable wipe.
 6. Place tape and wipes into container with broken glass.
- F. Disposal: Remove waste materials from Engineer's property and legally dispose of them using qualified transporters and destination facilities.

END OF SECTION 017419

SECTION 01740

WARRANTIES AND BONDS

PART 1 GENERAL

1.01 GENERAL

- A. Each CONTRACTOR shall provide warranties and bonds required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.
 - 1. Refer to paragraphs 7.17 of Article 7 of the General Conditions for the CONTRACTOR's General Warranty and Guarantee.
 - 2. Refer to paragraph 6.01 of Article 6 of the General Conditions for the CONTRACTOR's Performance/Payment Bond.
 - 3. General closeout requirements are included in Section 01770, Project Closeout.
 - 4. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Sections of Division 2 through 16. If not specifically specified otherwise, all equipment and products specified in Sections of Division 2 through 16 shall be provided with the CONTRACTOR's General Warranty and Guarantee.
 - 5. Certifications and other commitments and agreements for continuing services to OWNER shall be as specified elsewhere in the Contract Documents.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the CONTRACTOR of the warranty on the products nor on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the CONTRACTOR.

1.02 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The CONTRACTOR shall be responsible for the cost of replacing or rebuilding defective Work regardless of whether the OWNER has benefitted from use of the Work through a portion of its anticipated useful service life.
- D. OWNER's Recourse: Written warranties made to the OWNER are in addition to implied warranties and shall not limit the duties, obligations, rights and remedies otherwise available, nor shall warranty periods be interpreted as limitations on time in which the OWNER can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The OWNER reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- E. The OWNER reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments have done so.

1.03 SUBMITTALS

- A. Submit written warranties to the ENGINEER as required to receive approval of equipment or material and as required to be approved prior to Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the work, or a designated portion of the Work, submit written warranties upon request of the ENGINEER.
 1. When a designated portion of the Work is completed and occupied or used by the OWNER, by separate agreement with the CONTRACTOR during the construction period, submit properly executed warranties to the ENGINEER within fifteen days of completion of that designated portion of the Work.
- B. When a special warranty is required to be executed by the CONTRACTOR, or the CONTRACTOR and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the OWNER through the ENGINEER for approval prior to final execution.
 1. Refer to individual Sections of Division 2 through 16 for specific content requirements for warranties or bonds.
- C. Form of Submittal: At Project Closeout, compile two (2) copies of each required warranty and bond properly executed by the CONTRACTOR or by the CONTRACTOR, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Contract Documents.
- D. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
 2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the Project title or name, and the name of the CONTRACTOR.
 3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual. See Section S-01730, Operation and Maintenance Data.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01770

PROJECT CLOSEOUT

PART 1 GENERAL

1.01 GENERAL

- A. Administrative and procedural requirements for project closeout include but are not limited to:
 - 1. Substantial completion.
 - 2. Final inspection, payment and acceptance.

1.02 SUBSTANTIAL COMPLETION

- A. In addition to the requirements of Article 15 of the General Conditions, CONTRACTOR shall comply with following paragraphs and notify ENGINEER of any exceptions.
- B. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following:
 - 1. Application for Payment that coincides with, or first follows, date Substantial Completion is claimed. Include supporting documentation for completion as indicated in these Contract Documents and statement showing accounting of changes to Contract Amount, if any.
 - 2. Where Substantial Completion has not been attained, include list of incomplete items, value of incomplete construction, and reasons Work is not complete.
 - 3. Advise OWNER of pending insurance change over requirements.
 - 4. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, inspections by authorities (building, electrical, plumbing, boilers, fire marshal, elevators and similar items) and similar documents. Refer to Section 01740, Warranties and Bonds, if that Section is included in the Contract Documents.
 - 5. Obtain and submit releases enabling OWNER unrestricted use of Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
 - 6. Submit record drawings, maintenance manuals, final project photographs and negatives, damage or settlement survey, property survey, and similar final record information. CONTRACTOR shall also comply with the requirements of the following Sections if the Section is included in the Contract Documents:
 - a. Section 01720, Record Documents.
 - b. Section S-01380, Construction Photographs.
 - c. Section S-01730, Operation and Maintenance Data.

7. Deliver tools, spare parts, extra stock, and similar items. CONTRACTOR shall also comply with the requirements of the following Sections if the Section is included in the Contract Documents:
 - a. Section S-01760, Spare Parts and Maintenance Materials.
 8. Make final changeover of permanent locks and transmit keys to OWNER. Advise OWNER's personnel of change over in security provisions.
 9. Complete start up testing of systems, and instruction of OWNER's operating and maintenance personnel. CONTRACTOR shall also comply with the requirements of the following Sections if the Section is included in the Contract Documents:
 - a. Section S-01661, Field Tests of Equipment.
 - b. Section S-01662, Instruction of Operation and Maintenance Personnel.
 - c. Section S-01663, Starting and Placing Equipment in Operation.
 10. Discontinue or change over and remove temporary facilities from site, along with construction tools, mock-ups, and similar elements.
 11. Complete final clean up requirements, including touch-up painting. Provide touch-up painting and otherwise repair and restore marred exposed finishes. CONTRACTOR shall also comply with the requirements of the following Sections if the Section is included in the Contract Documents:
 - a. Section 01710, Cleaning.
 - b. Section S-09900, Painting.
- C. Inspection procedures: On receipt of request for certification, ENGINEER will inspect to determine the status of completion as described in Article 15.03 of the General Conditions.

1.03 FINAL INSPECTION, PAYMENT AND ACCEPTANCE

- A. In addition to the requirements of Article 15 of the General Conditions, CONTRACTOR shall comply with the following paragraphs and notify ENGINEER of any exceptions.
- B. Preliminary Procedures: Before submitting a Final Application for Payment, CONTRACTOR shall request a Final Inspection as described in Article 15 of the General conditions, paragraph 15.05. After all corrections are complete, CONTRACTOR shall submit final application for payment.
- C. In addition to the requirements of Article 15 of the General Conditions, Paragraph 15.06, CONTRACTOR shall include the following with the Final Application for Payment:
 1. Submit releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 2. Submit updated final statement, accounting for final additional changes to Contract Amount, if any.

3. Submit certified list of items to be completed or corrected, developed during certification of Substantial Completion and amended as necessary.
 4. Submit final meter readings for utilities, measured record of stored fuel, and similar data as of date of Substantial Completion or when OWNER took possession of and responsibility for corresponding portions of Work.
 5. Submit consent of surety to final payment and Contractor's Affidavit of Payment.
 6. Submit final liquidated damages settlement statement, if any.
 7. Submit evidence of final, continuing insurance coverage complying with insurance requirements of Article 6 of the General Conditions. This shall include as a minimum, but not be limited to:
 - a. Status of CONTRACTOR's liability insurance.
 - b. Status of CONTRACTOR's property insurance.
 - c. Status of CONTRACTOR's Performance/Payment Bond.
 - d. Status of CONTRACTOR's maintenance agreements and similar continuing commitments required by the Contract Documents.
- D. ENGINEER will recommend Final Payment and Acceptance in accordance with Article 15 of the General Conditions, paragraph 15.06.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01771

CLOSEOUT PROCEDURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Warranties.
 - 2. Final cleaning.
 - 3. Repair of the Work.
- B. Related Requirements:
 - 1. Section 01730 "Execution" for progress cleaning of Project site.
 - 2. Section 01770 "Project Closeout" for additional closeout requirements.
 - 3. Section 01782 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 4. Section 01770 "Project Closeout" for submitting record Drawings, record Specifications, and record Product Data.

1.3 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Design Professional.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. PDF electronic file. Design Professional will return annotated file.

1.7 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Design Professional for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Engineer's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
1. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 – EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - e. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - f. Sweep concrete floors broom clean in unoccupied spaces.
 - g. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - h. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - i. Remove labels that are not permanent.
 - j. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - k. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

- l. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - m. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - (1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
 - n. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - o. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 5000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 01782

OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation manuals for systems, subsystems, and equipment.
 - 2. Product maintenance manuals.
 - 3. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 01 3300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Design Professional will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Design Professional.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer Comments on draft submittals.
- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Design Professional will return copy with comments.
 1. Correct or revise each manual to comply with Design Professional's comments. Submit copies of each corrected manual within 15 days of receipt of Design Professional's comments and prior to commencing demonstration and training.

PART 2 – PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Engineer.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Design Professional.
 7. Names and contact information for major consultants to the Design Professional that designed the systems contained in the manuals.
 8. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

- D. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

2.2 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.

7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.3 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and crossreference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
1. Product name and model number.
 2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.

- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.

4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 – EXECUTION

3.1 MANUAL PREPARATION

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Engineer's operating personnel.
- C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

- D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared record Drawings in Section 01 7839 "Project Record Documents."
- E. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 01790

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Engineer's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit one copies within seven of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:

- a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Design Professional.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.
2. At completion of training, submit complete training manual(s) for Engineer's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

- A. Coordinate instruction schedule with Engineer's operations. Adjust schedule as required to minimize disrupting Engineer's operations and to ensure availability of Engineer's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Design Professional.

1.7 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.

- f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

1.8 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Engineer for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Engineer's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Design Professional will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Engineer will furnish an instructor to describe Engineer's operational philosophy.
 - 3. Engineer will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Engineer with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- F. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode.
 - 1. Submit video recordings on CD-ROM or thumb drive.
 - 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.

4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. Email address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
 1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
 1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- F. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900

TECHNICAL SPECIFICATIONS

SECTION 024119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes:

1. Demolition and removal of selected portions of exterior or interior of building or structure and site elements.
2. Removal and salvage of existing items for delivery to Engineer and removal of existing items for reinstallation.

B. Related Requirements:

1. Section 01100 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.
3. Section 013516 "Alteration Project Procedures" for general protection and work procedures for alteration projects.
4. Section 330500 "Common Work Results for Utilities" for removal of site utility systems piping, equipment, and components.

1.2 DEFINITIONS

- A. Remove:(Demo/Demolish) Detach items from existing construction and legally dispose of off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Engineer as indicated.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage; prepare for reuse; and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Engineer's operations.

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.
 - 6. Review and finalize protection requirements.
 - 7. Review procedures for noise control and dust control.
 - 8. Review storage, protection, and accounting for items to be removed for salvage or reinstallation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For refrigerant recovery technician.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection , for dust control and , for noise control. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Engineer's on-site operations are uninterrupted.
 - 2. Temporary interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Engineer's continuing occupancy of portions of existing building and of Engineer's partial occupancy of completed Work.
- D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed in accordance with EPA regulations. Include name and address of technician and date refrigerant was recovered.
- E. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Universal certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

- A. Engineer will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Engineer's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Engineer as far as practical.
 - 1. Before selective demolition, Engineer will remove the following items:
 - a. Furniture and equipment.
- C. Notify Design Professional of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials:
 - 1. It is not expected that hazardous materials will be encountered in the Work.
 - a. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Design Professional and Engineer. Hazardous materials will be removed by Engineer under a separate contract.
- E. On-site sale of removed items or materials is not permitted.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Engineer. Engineer does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video, measured drawings. Comply with Section 013233 "Photographic Documentation."
 - 1. Inventory and record the condition of items to be removed for salvage or reinstallation. Photograph or video conditions that might be misconstrued as damage caused by removal.
 - 2. Photograph or video existing conditions of adjoining construction including finish surfaces, that might be misconstrued as damage caused by selective demolition operations or removal of items for salvage or reinstallation.

3.2 PREPARATION

- A. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
- B. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Design Professional, items may be removed to a suitable, protected storage location and cleaned and reinstalled in their original locations after

selective demolition operations are complete.

- D. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment in accordance with 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND BUILDING SYSTEMS

- A. Existing Services/Systems to Remain: Maintain utilities and building systems and equipment to remain and protect against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utilities and building systems serving areas to be selectively demolished.
 - 1. Demolish and remove existing building systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment and components.
 - 2. Abandon existing building systems, equipment, and components indicated on Drawings to be abandoned in place.
 - a. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - b. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.
 - 3. Remove and reinstall/salvage existing building systems, equipment, and components indicated on drawings to be removed and reinstalled or removed and salvaged:
 - a. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment and components; when appropriate, reinstall, reconnect, and make equipment operational.
 - b. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and components and deliver to Engineer.

3.4 SALVAGE/REINSTALL

- A. Removed and Salvaged Items:
 - 1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Engineer.
4. Transport items to Engineer's storage area designated by Engineer.
5. Protect items from damage during transport and storage.

B. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 8 hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used

facilities without permission from Engineer and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete:
 - 1. Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
 - 2. Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive in accordance with recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 03 11 00 - CONCRETE FORMWORK

PART 1 GENERAL

1.1 DESCRIPTION

- A. Included are all concrete formwork and related items necessary for concrete work related to building construction.

1.2 RELATED WORK

- A. Section 032000: Concrete reinforcement
- B. Section 033000: Cast-in-Place Concrete

1.3 DESIGN REQUIREMENTS

- A. The design and engineering of the formwork, as well as its construction, shall be the responsibility of the Contractor.
- B. The formwork shall be designed for the loads, lateral pressures, and allowable stresses outlined in Section 102 and 103 of "Recommended Practice for Concrete Formwork" (ACI347) and wind loads so specified by controlling local building codes.
- C. Form shall conform to the shape, lines, and dimensions of the members as called for on the plans and shall be constructed so as to insure that the concrete surfaces will conform to the tolerances of Section 203.1 of (ACI-347).
- D. Plywood forms shall meet the requirements of the latest edition of U. S. Product Standard PS1 or one of American Plywood Association's performance-engineered proprietary specifications.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION 03 11 00

SECTION 03 20 00 - CONCRETE REINFORCEMENT

PART I GENERAL

1.1 DESCRIPTION

- A. Included is all steel bar, welded wire fabric reinforcing, and related items necessary for concrete work related to building construction. Reinforcing steel shall be detailed, fabricated and placed in accordance with codes and requirements specified herein.

1.2 RELATED WORK

- A. Section 03 11 00: Concrete Formwork
- B. Section 03 30 00: Cast-in-Place Concrete

1.3 QUALITY ASSURANCE

- A. Acceptable Manufacturers: Regularly engaged in the manufacture of steel bars and welded wire fabric reinforcing.
- B. Installers Qualifications:
 - 1. Three (3) years experience in installation of steel bar and welded wire fabric reinforcing.
 - 2. Welders qualified in accordance with AWS D 12.1-61.
- C. Source Quality Control: Mill test certificates identifying chemical and physical analysis of each load of reinforcing steel delivered.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Detail reinforcing steel in accordance with ACI-315-74, "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Show sizes and dimensions for fabrication and placing reinforcing steel and accessories. Indicate bar schedules, tie and stirrup spacing, and diagrams of bar bends.
 - 2. Before submittal to the Engineer, shop drawings shall be checked and approved by the Contractor to verify that bar details are in conformity with the design drawings and are consistent with the anticipated concrete pours.
 - 3. Submit 5 copies of shop drawings to the Engineer that show the approval by the Contractor. Do not fabricate reinforcing steel until approval of the Engineer has been obtained.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length. Handle and store materials to prevent contamination or deterioration. Handle welding electrodes in accordance with AWS D 12.1.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All bar reinforcement shall be intermediate or hard grade billet or rail steel, ASTM A615 or A616, Grade 60 or 40 and conforming to A-305. All #3 and #4 Ties and Stirrups to be Grade 40. All other to be Grade 60 unless shown otherwise on plans.
- B. Welded wire fabric reinforcing shall conform to ASTM A185.
- C. All accessories to be of standard types as called for in ACI 315-74. Accessories are to plastic coated, stainless steel or galvanized, where surface on which they rest is exposed.
- D. Other Supports: Concrete brick may be used to support reinforcing in foundation to obtain proper clearances from the earth.

2.2 FABRICATION

- A. Bars shall be prefabricated to detail and delivered to the job plainly tagged and ready to set. Bends and hooks shall conform to ACI Specifications. Beam stirrups and column ties shall not have dimension errors more than one bar diameter and the depth of truss bends shall not be in error more than ½ bar diameter.

PART 3 EXECUTION

3.1 INSPECTION

- A. Reinforcing for one day's pour shall be completely placed and inspection made by the Engineer prior to pouring.

3.2 INSTALLATION

- A. Reinforcement shall be securely tied at all intersections with #18 black annealed wire and be carried on spaces of sufficient weight and number to properly support bars.
- B. Placement:
 - 1. Bar Supports: CRSI 65
 - 2. Reinforcing Bars: CRSI 63
- C. Steel Adjustment:
 - 1. Move within allowable tolerance to avoid interference with other reinforcing steel, conduits or embedded items.
 - 2. Do not move bars beyond allowable tolerances without concurrence of the Engineer.
 - 3. Do not heat, bend, or cut bars without concurrence of the Engineer.
- D. Splices:
 - 1. Lap Splices: Tie securely with wire to prevent displacement of splices during placement of concrete.
 - 2. Splice Devices: Install in accordance with manufacturer's written instructions.
 - 3. Welding: Perform in accordance with AWS 12.1.
 - 4. Do not splice bars except at locations shown on drawings without concurrence of the Engineer.

- E. Wire Fabric:
 - 1. Install in longest practicable lengths.
 - 2. Lap adjoining pieces 1'-0" minimum and lay splices with #16 gauge wire.
 - 3. Offset end laps in adjacent widths to prevent continuous laps.
 - 4. Wire fabric reinforcing for slabs on fill shall be placed approximately in center of slab.
- F. Footing Foundations: Install vertical dowel steel as required before placing concrete. Provide template to hold dowels in proper position and alignment.
- G. Cleaning: Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that will reduce bond with concrete.
- H. Protection during Concreting: Keep reinforcing steel in proper position during concrete placement.

END OF SECTION 03 20 00

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 DESCRIPTION

- A. Prepare sub-grade to receive base course materials for concrete pavements.
- B. Place and compact base course materials for concrete pavements.
- C. Provide concrete pavements, sidewalks and miscellaneous site concrete work, complete with reinforcement where required.

1.2 RELATED WORK

- A. Section 01 33 23: Shop Drawings, product Data, and Samples
- B. Section 01 45 23: Testing and Inspection Services
- C. Section 31 20 00: Earth Moving
- D. Section 07 92 00: Joint Sealants

1.3 REFERENCE STANDARDS

- A. ASTM C150 - Portland Cement
- B. ASTM C94 - Ready-mixed Concrete
- C. ASTM C260 - Air-Entraining Admixtures for Concrete
- D. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- E. ASTM C33 - Concrete Aggregates
- F. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction
- G. ASTM C308 - Liquid Membrane Forming Compounds for Curing Concrete

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Crushed aggregate base: Angular pit run crushed natural carbonate stone; free from shale, clay, and friable materials and debris; graded within the following limits:

Sieve Size	% Passing
2 inches	100
1 inch	70 - 90
¾ inch	50 - 85
No. 4	25 - 60
No. 40	7 - 30
No. 200	0 - 15

2.2 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150; normal - type 1
- B. Fine and Coarse Aggregates: ASTM C33
- C. Water: Clean and free from injurious amounts of oil, alkali, organic matter, or other deleterious material
- D. Air Entrainment: ASTM C260
- E. Only one type and manufacturer of approved cement shall be used throughout this project.

2.3 CONCRETE ACCESSORIES

- A. Formwork: Matched, tight fitting and adequately stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of concrete.
- B. Joint Filler: One half inch thick, asphaltic impregnated vegetable fiber and finely divided mineral filler, ASTM D1751.
- C. Curing Compound: VOC compliant, rapid decomposing resin curing compound shall be Safe-Cure Clear as manufactured by ChemMasters, Inc. or approved equal.
- D. Concrete Sealer (non-colored concrete): A water-based silane/siloxane water repellent such as Weather Seal Siloxane WB as manufactured by Prosoco, Spall Guard WB 10% by ChemMasters, Inc., or approved equal.
- E. Concrete Stain for colored concrete: Lithochrome Tintura Stain (non acid stain) as manufactured by Scofield Systems or approved equal. Colors as selected by the Landscape Architect.
- F. Sealer for colored concrete: Selectseal-W (water based/low VOC) as manufactured by Scofield Systems or approved equal.

2.4 CONCRETE MIX

- A. Mix and proportion to produce minimum 4000 psi concrete at 28 days with maximum slump of 4 inches and 6 percent plus or minus 1-1/2% air entrainment, ASTM C94.
- B. Use accelerating admixtures in cold weather only when acceptable to Landscape Architect. Use of admixtures shall not relax cold weather placement requirements. Do not use calcium chloride nor fly ash.
- C. Use set-retarding admixtures during hot weather only when acceptable to Landscape Architect.

2.5 SAMPLE

- A. The Contractor shall provide a 3' x 3' sample slab of each required concrete finish for the Landscape Architect's approval, to insure the desired texture and appearance. Once a sample has been approved, this shall become the standard for the remainder of the job.
- B. The materials including mix design and finishing techniques proposed for use on the job will be those used in the sample. Also the same curing and sealing methods proposed for use on the job should be used for the approved sample

PART 3 EXECUTION

3.1 PREPARATION OF SUB-GRADE

- A. Ensure rough grading has brought sub-grade to required elevations.
- B. Fill soft spots and hollows with additional fill
- C. Level and compact sub-grade to receive granular base for concrete walks, curbs, and paving to 98% maximum dry density.

3.2 PLACEMENT OF GRAVEL FILL

- A. Place and level crushed aggregate base over prepared sub-grade to a compacted depth of 4 inches (or as shown on the drawings) true to lines and levels. Compact until no further increase in density is obtainable.

3.3 FORMING

- A. Form vertical surfaces to full depth and securely position to required lines and levels.
- B. Ensure form ties are not placed so as to pass through finished faces of concrete work, unless otherwise approved by the Landscape Architect
- C. Arrange and assemble formwork to permit easy dismantling and stripping, and to prevent damage to concrete during formwork removal.

3.4 PLACING REINFORCING

- A. Reinforce concrete pavement and structures as shown on the drawings. Allow for minimum 1-1/2 inch concrete cover.
- B. Do not extend reinforcing through expansion joints.

3.5 JOINTS

- A. Construct expansion, control and construction joints true-to-line with face perpendicular to surface concrete. Where possible, make joints of curbs coincide with joints in walks. When sidewalks abut building, and other vertical stationary structures, provide continuous joint filler.
- B. Provide control joints, sectioning concrete into areas indicated. Construct joints for a depth equal to at least one-fourth (1/4) of the concrete thickness.
 - 1. Broom finish concrete walks: Provide hand tooled control joints in pattern indicated. Do not allow edges of tooled joint to become depressed below adjacent concrete surface.
- C. Provide construction joints at the end of all pours and at locations where placement operations are stopped for a period of more than one-half hour, except where such pours terminate at expansion joints.
 - 1. Construct joints with standard keyed-section forms.
- D. Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects.
 - 1. Locate expansion joints as indicated on the drawings, or as specified herein; set perpendicular to longitudinal axis of walks, curbs and paving. Align expansion joints in abutting curbs and walks.
 - 2. Extend joint fillers full-width and depth of joint. Maintain top edge not more than 1/8 inch below finished surface. Recess top edge 1/2 inch if joints are to be sealed.
 - 3. Furnish joint fillers in one-piece lengths for the full width being placed, whenever possible. Where more than one length is required, clip joint filler sections together.
 - 4. Protect the top edge of the joint filler during concrete placement.

3.6 CONCRETE TEST

- A. Testing of concrete will be performed by an independent testing laboratory employed and paid for by the Contractor and acceptable to the Landscape Architect and the Owner. All work shall be in accordance with Section 01410. Testing and inspection will be performed so as to minimize disruption to Work.
- B. Compressive Strength Testing: Test cylinders sets shall be made from concrete delivered to the job site.
 - 1. One (1) twenty-eight (28) day test and one (1) seven (7) day test equals one set of tests. Provide one set of test cylinders for each fifty (50) cubic yards of concrete delivered to the job site.
 - 2. Test specimens shall be taken and tested in accordance with ASTM Specifications for "Compression Test of Concrete". Results of tests shall immediately be submitted to the Landscape Architect.
 - 3. Where the ultimate 28 days compressive strength of concrete in any test cylinder falls below the strength for the class of concrete tested, or below proportional minimum

seven day strengths, that portion of concrete shall be removed and replaced at no additional cost to the Owner.

- C. Air and Slump Testing:
 - 1. A minimum of one test each (air and slump) shall be made for each load of concrete delivered to job site and each test cylinder set taken. Results of air and slump tests shall be referenced to test cylinder sets when applicable. Results of tests shall immediately be submitted to the Landscape Architect.
 - 2. Do not obtain samples from the very first or last portions of the batch.
- D. Failure to detect any defective work or materials shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the Owner or Landscape Architect for final acceptance.

3.7 PLACING AND FINISHING CONCRETE

- A. Place concrete, screed and wood float surfaces to a smooth and uniform finish, free of open texturing and exposed aggregate.
- B. Avoid working mortar to surface. Finishing operations shall be kept to an absolute minimum for exterior work and where broom finishes are required, normally no troweling is required. No working of the concrete will be allowed while bleed water is on the surface as this tends to weaken the surface and significantly contributes to potential scaling.
- C. Provide applicable concrete finishes as follows:
 - 1. Broom finish: (for all standard flatwork unless otherwise noted on the drawing).
 - a. Provide exterior pavement surfaces with a medium broom textured finish.
 - b. Ramps: provide a non-slip heavy broom finish
 - c. Curbs: smooth brushed finish
 - d. Steps: Medium broom textured finish.
- D. Round all edges, including edges of dummy and expansion and contraction joints, with 1/2 radius edging tool.
- E. Ensure finished surfaces do not vary from true lines, levels, or grade by more than 1/8 inch in 10 feet when measured with straight edge.
- F. Concrete shall be placed so as to avoid any segregation of planes between pours and shall be vibrated or puddled as required to provide a smooth surface free from honeycomb or segregation. After forms are removed, all tie holes or honeycomb shall be pointed and exposed surfaces shall have fins removed by rubbing with carborundum and water to produce a smooth, even surface.
- G. Apply curing compound on all concrete finished surfaces immediately after placement. Apply in accordance with manufacturer's recommendations.
- H. Apply concrete sealer after the concrete has cured at least twenty eight days. Concrete surfaces must be clean and dry prior to application. Remove all stains and curing compound residue prior to sealing. Temperature of the concrete shall be not less than 45 degrees F. Apply in accordance with manufacturer's recommendations.
- I. Provide for heating of concrete materials and the wet concrete during freezing or near freezing weather. No frozen materials or materials containing ice shall be used. All concrete materials and all reinforcing forms, fillers and ground with which the concrete is to be in contact shall have a temperature of between 70 degrees and 80 degrees F., and adequate means shall be provided for maintaining a temperature of not less than 70 degrees F. for three days or 50 degrees F. for five days after concrete is poured. Follow recommended ACI-305 practice for hot weather concreting. Admixture for the purpose of accelerating or retarding set shall be utilized only upon the approval and instructions of the Landscape Architect. Water reducing admixture may be used to improve workability or reduce water content upon prior approval of the Landscape Architect. Concrete shall be placed within one and one-half hours from the time it is batched.

3.8 CONCRETE WALLS

- A. Concrete shall be placed in such manner as to prevent segregation and accumulations of hardened concrete on forms or reinforcement above mass of concrete being placed. To achieve this end, suitable hoppers, spouts with restricted outlets and tremies shall be used as required.
- B. During and immediately after depositing, concrete shall be thoroughly compacted by means of internal type mechanical vibrators or other tools, spading to produce required quality of finish. Vibration shall be done by experienced operators under close supervision and shall be carried on only enough to produce homogeneity and optimum consolidation without permitting segregation of constituents or "pumping" of air. Vibrators used for normal weight concrete shall operate at speed at no less than 8,000 rpm and be of suitable capacity. Do not use vibrators to move concrete. Vibration shall be supplemented by proper wooden spade puddling to remove included bubbles and honeycomb adjacent to visible surfaces. At least one vibrator shall be on hand for every 10 cubic yards of concrete placed per hour, plus one spare. Vibrator shall be operable and on site prior to starting placement.
- C. Vertical lifts shall not exceed 18 inches. Vibrate through successive lifts to avoid pour lines. Vibrate first lift thoroughly until top of lift glistens to avoid stone pockets, honeycomb, and segregation.
- D. Concrete shall be deposited continuously, and in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause formation of seams and planes of weakness within section. If section cannot be placed continuously between planned construction joints, as specified, field joint and additional reinforcement shall be introduced so as to preserve structural continuity. Architect shall be notified in any such case.
- E. Cold joints, particularly in exposed concrete, including "honeycomb", are unacceptable. If they occur in concrete surfaces exposed to view, Architect will require that entire section in which blemish occurs be removed and replaced with new materials at Contractor's expense.

3.9 REPAIR AND PROTECTION

- A. Protect concrete from damage until acceptance of work. Exclude traffic for at least 14 days. When construction traffic is permitted, maintain walks and pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- B. Repair defective concrete to match color and texture of adjacent surfaces.
- C. Sweep concrete sidewalks and pavement and wash free of stains, discolorations, dirt and other foreign material immediately prior to project acceptance.

END OF SECTION 03 30 00

SECTION 042200
CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout materials.
3. Reinforcement.
4. Masonry-joint reinforcement.
5. Miscellaneous masonry accessories.

B. Products Installed, but Not Furnished, under This Section:

1. Steel lintels and steel shelf angles in accordance with Section 055000 "Metal Fabrications" in concrete unit masonry.

C. Related Requirements:

1. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Lintel design and types required.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:
1. Masonry units.
 - a. Include data on material properties.
 - b. For masonry units include data and calculations establishing average net-area compressive strength of units.
 2. Cementitious materials. Include name of manufacturer, brand name, and type.
 3. Mortar admixtures.
 4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 5. Grout mixes. Include description of type and proportions of ingredients.
 6. Reinforcing bars.
 7. Joint reinforcement.
 8. Anchors, ties, and metal accessories.
- B. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
 2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined in accordance with TMS 402/602.

1.5 QUALITY ASSURANCE

- A. Project team craftworkers of the Masonry Contractor assigned to Project will be required to have the International Masonry Institute - Flashing Training or equal and to provide evidence of certificate or a letter of the firm's commitment to enroll key project personnel in the training program prior to the start of Project.
- B. Project team craftworkers of the Masonry Contractor assigned to Project will be required to have the International Masonry Institute - Grouting and Reinforcing Training or equal and to provide evidence of certificate or a letter of the firm's commitment to enroll key project personnel in the training program prior to the start of Project.
- C. Testing Agency Qualifications: Qualified in accordance with ASTM C1093 for testing indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is

40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) in accordance with Tables 1 and 2 in TMS 402/602.

2.2 CONCRETE UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 402/602 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 ft. vertically and horizontally of a walking surface.
- C. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
- D. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing in accordance with ASTM E119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.3 CONCRETE MASONRY UNITS

- A. Standard CMUs: Load-bearing ASTM C90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of .
 - 2. Density Classification: Normal weight.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
- B. Architectural CMUs: Load bearing, ASTM C90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
 - 2. Density Classification: Normal weight.

3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
4. Pattern and Texture:
 - a. Scored vertically so units laid in running bond appear as square units laid in stacked bond, standard finish. Match existing.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 1. Alkali content is not more than 0.1 percent when tested in accordance with ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Aggregate for Mortar: ASTM C144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- E. Water: Potable.

2.5 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Use portland cement-lime mortar unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
 4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- B. Where existing masonry occurs, match coursing, bonding, color, and texture of existing masonry.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 2. Bed webs in mortar in all courses of piers, columns, and pilasters.

3. Bed webs in mortar in grouted masonry, including starting course on footings.
- B. Where applicable, set masonry trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 2. Wet joint surfaces thoroughly before applying mortar.
 3. Rake out mortar joints for pointing with sealant.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.5 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as Work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

3.6 MASONRY WASTE DISPOSAL

- A. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Engineer's property.

END OF SECTION 042200

SECTION 055000
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Miscellaneous framing and supports.
 - 2. Abrasive metal nosings, treads, and thresholds.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Fasteners.
 - 2. Shop primers.
 - 3. Shrinkage-resisting grout.
 - 4. Slotted channel framing.
 - 5. Abrasive metal nosings, treads, and thresholds.

1.4 INFORMATIONAL SUBMITTALS

- A. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

- D. Research Reports: For post-installed anchors.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.
- D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.
- E. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- F. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- G. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: As indicated.
 - 2. Galvanized Steel: ASTM A653/A653M, structural steel, Grade 33, with G90 coating; 0.079-inch nominal thickness.
 - 3. Cold-Rolled Steel: ASTM A1008/A1008M, structural steel, Grade 33; 0.0677-inch

minimum thickness; hot-dip galvanized after fabrication.

- H. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
- I. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- J. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.
- K. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

FASTENERS

- L. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless steel fasteners for fastening aluminum or stainless steel.
 - 2. Provide bronze fasteners for fastening bronze.
- M. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- N. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.
- O. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.
- P. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- Q. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- R. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- S. Post-Installed Anchors: chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

- T. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.3 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer that contains pigments that make it easily distinguishable from zinc-rich primer.
- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.4 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.5 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.
 1. Fabricate units from slotted channel framing where indicated.
 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
 1. Provide bearing plates welded to beams where indicated.
 2. Drill or punch girders and plates for field-bolted connections where indicated.
 3. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.
- D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
 1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
 2. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts

and 1/4-inch top plates.

- E. Galvanize miscellaneous framing and supports where indicated.

2.6 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize and prime shelf angles located in exterior walls.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.7 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches unless otherwise indicated.
- C. Galvanize and prime loose steel lintels located in exterior walls.

2.8 ABRASIVE METAL NOSINGS, TREADS, AND THRESHOLDS

- A. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - 1. Provide solid-abrasive-type units without ribs.
 - 2. Nosings:
 - a. Square-back units, 3 inches wide, for casting into concrete steps.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

- C. Apply bituminous paint to concealed surfaces of cast-metal units.
- D. Apply clear lacquer to concealed surfaces of extruded units.

2.9 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.10 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
 - 5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification

No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.12 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported,

including manufacturers' written instructions and requirements indicated on Shop Drawings.

- B. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.3 INSTALLATION OF ABRASIVE METAL NOSINGS, TREADS, AND THRESHOLDS

- A. Center nosings on tread widths unless otherwise indicated.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

3.4 REPAIRS

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

SECTION 055213

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum railings.

1.2 COORDINATION

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Perforated metal infill panels.
3. Fasteners.
4. Post-installed anchors.
5. Handrail brackets.
6. Bituminous paint.
7. Nonshrink, nonmetallic grout.
8. Metal finishes.

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

- C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
2. Fittings and brackets.

- D. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For delegated design professional engineer.
- B. Welding certificates.
- C. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.
- D. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.

- c. Uniform and concentrated loads need not be assumed to act concurrently.
- 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 ALUMINUM RAILINGS

- 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. Julius Blum & Co., Inc.
 - 2. Superior Aluminum Products, Inc
 - 3. Tubular Specialties Manufacturing, Inc.
- B. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- C. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- D. Extruded Bars and Tubing: ASTM B221, Alloy 6063-T5/T52.
- E. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
- F. Drawn Seamless Tubing: ASTM B210/B210M, Alloy 6063-T832.

2.4 FASTENERS

- A. Fastener Materials:
 - 1. Aluminum Railing Components: Type 304 stainless steel fasteners.
 - 2. Finish exposed fasteners to match appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
 - 2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 - 3. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
 - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: Cast aluminum, center of handrail 3-1/8 inches from face of railing.
- B. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.
- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- D. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded or nonwelded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.
- I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection, using an epoxy structural adhesive, if this is manufacturer's standard splicing method.

- K. Form changes in direction as follows:
1. As detailed.
 2. by inserting prefabricated elbow fittings.
 3. By bending to smallest radius that will not result in distortion of railing member.
- L. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- M. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 2. Coordinate anchorage devices with supporting structure.
- Q. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
- R. For removable railing posts, fabricate slip-fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.
1. Provide socket covers designed and fabricated to resist being dislodged.
 2. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

2.7 ALUMINUM FINISHES

- A. 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 the 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.

- B. Mill Finish: AA-M12, nonspecular as fabricated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
1. Fit exposed connections together to form tight, hairline joints.
 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For aluminum railings, attach posts as indicated, using fittings designed and engineered for this purpose.

3.5 CLEANING

- A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

3.6 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

SECTION 061000
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood products.
2. Wood-preservative-treated lumber.
3. Fire-retardant-treated lumber.
4. Miscellaneous lumber.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. Lumber grading agencies, and abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NLGA: National Lumber Grades Authority.
 3. SPIB: The Southern Pine Inspection Bureau.
 4. WCLIB: West Coast Lumber Inspection Bureau.
 5. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. Include data for fire-retardant treatment from chemical treatment manufacturer and

certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

1.5 DELIVERY, STORAGE, AND HANDLING

- ##### A.
- Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

- ##### A.
- Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
 3. Dress lumber, S4S, unless otherwise indicated.
- ##### B.
- Maximum Moisture Content:
1. Boards: 15 percent.
 2. Dimension Lumber: 15 percent unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED LUMBER

- ##### A.
- General: Where fire-retardant-treated materials are indicated, materials are to comply with

requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Treatment is not to promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated (PT).
 - 3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber is to be tested according to ASTM D5664 and design value adjustment factors are to be calculated according to ASTM D6841.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by authorities having jurisdiction.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat all rough carpentry unless otherwise indicated.
 - 1. Exterior Fire-retardant-treated wood for wood blocking at roof (PT).

2.3 MISCELLANEOUS LUMBER

- A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Cants.
 - 3. Furring.
 - 4. Utility shelving.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

- C. Roofing Nailers: Structural- or No. 2-grade lumber or better; kiln-dried Douglas fir, southern pine, or wood having similar decay-resistant properties.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.5 FASTENERS

- A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC58 as appropriate for the substrate.

2.6 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- B. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
- C. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- F. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
- I. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.
- J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.

3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 064100

ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad casework.
2. Wood materials.
3. Casework hardware.
4. Accessories.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
2. Section 123661 "Simulated Stone Countertops."

1.2 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1. Review locations and method of attachment of backing required for casework installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include panel material description and finish.
2. Include accessories.
3. Include hardware.

- B. Shop Drawings:

1. Plans, elevations, sections, and attachment details.
 - a. Show large-scale details.
 - b. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - c. Show locations and sizes of cutouts and holes for items installed in architectural cabinets.
 - d. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
 - C. Samples for Initial Selection: For each exposed product and for each color and finish specified, in manufacturer's standard size.
 - D. Samples for Verification: Provide a minimum of three samples showing the full range of color and/or grain to be expected in the finished work, for the following.
 1. Plastic Laminates: 8 by 8 inches, for each type, color, pattern, and surface finish required.
 - a. Provide one Sample applied to core material with specified edge material applied to one edge.
 2. Thermally Fused Laminate (TFL) Panels: 8 by 10 inches, for each color, pattern, and surface finish.
 - a. Provide edgebanding on one edge.
 3. Corner Pieces:
 - a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
 4. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Test Reports: Valid AWI "Performance Quality Test Report" indicating compliance with specified ANSI/AWI 0641 Structural Performance Duty Level.
 - B. Product Certificates: For each type of product.
 - C. Field quality control reports.
 - D. Qualification Statements: For manufacturer and Installer.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Manufacturer of products.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

- A. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 45 percent during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Unless otherwise indicated, comply with ANSI/AWI 0641 for duty level and grade of architectural cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of the Contract Documents in addition to those of the referenced quality standard.

2.2 PLASTIC-LAMINATE-CLAD CASEWORK

- A. Architectural Woodwork Institute (AWI) Standard:
 - 1. Structural Performance Duty Level: 2.
 - 2. Aesthetic Performance Grade: Premium.
 - 3. Composite Wood Products: Verify formaldehyde emission rates are not greater than the following when tested in accordance with ASTM D6007 or ASTM E1333:
 - a. Hardwood Plywood: 0.05 ppm.
 - b. Particleboard: 0.09 ppm.
 - 4. Verify adhesives have a VOC content of 30 g/L or less.
- B. Casework Construction Type: Face frame.
- C. Door and Drawer-Front:
 - 1. Design: Flush panel.
 - 2. Style: Reveal overlay.
 - a. Reveal Dimension: As determined by hinge type and clearance.
- D. High-Pressure Decorative Laminate (HDPL): ISO 4586-3, grades as indicated or, if not indicated, as required by quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Formica Corporation
 - b. Laminart LLC
 - c. Pionite; a Panolam Industries International, Inc. brand
 - d. Wilsonart LLC
- E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated on the drawings.
- F. Exposed Exterior Surfaces:
 - 1. Plastic-Laminate Grade: HGS.
 - 2. Pattern Direction: As indicated on Drawings.
 - 3. Edgebanding: High-pressure decorative laminate (HDPL).
- G. Exposed Interior Surfaces: Thermally fused laminate (TFL) the same color and pattern as exterior surfaces.
 - 1. Edgebanding: High-pressure decorative laminate (HDPL).

H. Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermally fused laminate (TFL) panels.
2. Drawer Sides and Backs: Thermally fused laminate (TFL) panels with PVC or polyester edgebanding.
3. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate (HDPL), ISO 4583-3, grade to match exposed surface.
4. Drawer Bottoms: Thermally fused laminate (TFL) panels.
5. Shelves: Adjustable.
 - a. Loading Capacity: 40 lb/sq. ft.
6. Edgebanding: High-pressure decorative laminate (HDPL).

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
2. Wood Moisture Content:
 - a. Climate-Controlled Environments: 6 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

- a. Hardwood Plywood: 0.05 ppm.
 - b. Particleboard: 0.09 ppm.
 - c. MDF More Than 5/16 Inch (8 mm) Thick: 0.11 ppm.
 - d. MDF 5/16 Inch (8 mm) or Less in Thickness: 0.13 ppm.
2. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
3. Softwood Plywood: DOC PS 1, medium-density overlay.
4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
5. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of AWI 300.

2.4 CASEWORK HARDWARE

A. Hinges:

1. Butt Hinges: 2-3/4-inch, Grade 1 five-knuckle steel hinges made from 0.095-inch- thick metal, and as follows:

- a. Semi-Concealed Hinges, Back Mounted, for Flush Doors: ANSI/BHMA A156.9, B01361.
- B. Pulls and Knobs:
 - 1. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011, 3-inch centers.
 - 2. Back-Mounted Knobs: ANSI/BHMA A156.9, B02041.
- C. Catches and Latches:
 - 1. Ball Friction Catches: ANSI/BHMA A156.9, B03013.
- D. Shelf Rests and Standards:
 - 1. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.
 - 2. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.
- E. Drawer Slides: ANSI/BHMA A156.9.
 - 1. Standard Duty (Grade 1 and Grade 2): Side mount.
 - 2. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mount.
 - a. Type: Full extension.
 - b. Material: Aluminum slides.
 - c. Motion Feature: soft close dampener.
 - 3. Drawer Types:
 - a. Pencil drawers not more than 3 inches high and not more than 24 inches wide provide 50 lb load capacity.
 - b. General-purpose drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide 75 lb load capacity.
 - c. File drawers more than 6 inches high or more than 24 inches wide provide 100 lb load capacity.
 - d. Lateral file drawers more than 6 inches high and more than 24 inches, but not more than 30 inches wide, provide 150 lb load capacity.
 - e. Lateral file drawers more than 6 inches high and more than 30 inches wide provide 200 lb load capacity.
 - f. Computer keyboard tray provides 75 lb load capacity.
- F. Door Bumpers: Manufacturer's standard self-adhering clear silicone pads.
- G. Hardware Finish:
 - 1. Exposed Hardware: Provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
 - a. Satin Stainless Steel: ANSI/BHMA 630.

2. Concealed Hardware: Manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.5 ACCESSORIES

A. Grommets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Doug Mockett & Company, Inc.
 - b. Hafele America Co.
 - c. W.W. Grainger, Inc.
2. Wire-Management Grommets: Circular, grommets and matching caps with slot for wire passage.
 - a. Finish: Molded plastic.
 - b. Outside Diameter: 2 inches.
 - c. Color: Black.

2.6 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated. Ease sharp edges and corners.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 1. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
 - 2. Verify size and locations of cutouts for appliances, special equipment, sinks, plumbing, and other items to be mounted in or adjacent to casework.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.3 INSTALLATION OF CASEWORK

- A. Install casework to comply with requirements of the structural and aesthetic performance specified.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
 - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 3. Maintain veneer sequence matching of cabinets with transparent finish.
- D. Anchor cabinets in accordance with AWI requirements or tested method to anchors or blocking built in or directly attached to framing or substrates.
 - 1. Install cabinets to comply with seismic requirements as indicated on Drawings.

3.4 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where impossible to repair, replace architectural cabinets. Adjust joinery for uniform

appearance.

- B. Clean, lubricate, and adjust hardware and other moving parts to function smoothly.
- C. Clean cabinets on exposed and semiexposed surfaces. Touch up finishes to restore damaged or soiled areas.

END OF SECTION 064100

SECTION 078413

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Penetration firestopping systems.
 - 1. Penetration firestopping systems in fire-resistance-rated walls.
 - 2. Exposed penetration firestopping systems.
- B. Related Requirements:
 - 1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.
 - 2. Section 079200 "Joint Sealants" for non-fire-resistance-rated joint sealants.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
- C. Unlisted Firestopping Systems: Obtain an Engineering Judgment (EJ) from firestopping manufacturer where no UL, FM Approvals, or other listed assembly is available for particular firestop configuration. Follow International Firestop Council (IFC) recommended guidelines for evaluating firestopping systems in EJs.
 - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) recommended guidelines. Obtain approval of authorities having jurisdiction prior to submittal.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Entity that has been approved by FM Approvals in accordance with FM Approvals 4991 or been evaluated by UL Solutions and found to comply with "UL Solutions Qualified Firestop Contractor Program."
- B. Manufacturer Qualifications: Entity that has received UL Solutions' "Firestop Movement Certification," which demonstrates that manufacturer's firestopping products designated with M-Ratings are based on exposure to cyclic movement and UL 1479 fire test evaluation when tested in accordance with ASTM E3037.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping systems when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping system materials in accordance with manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be accessed and installed in accordance with specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain penetration firestopping systems for each type of opening indicated from single manufacturer.

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M Building and Construction
 - 2. Hilti, Inc.
 - 3. Tremco Incorporated
- B. Penetration firestopping systems must be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 - 1. Penetration firestopping systems must be installed with products bearing the classification marking of a qualified testing agency.
 - a. UL Solutions in its online directory "Product iQ."
 - 2. Provide components for each penetration firestopping system that, upon curing, do not re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during and after construction.
 - 3. Provide components for each penetration firestopping system that do not contain ethylene glycol.
 - 4. Provide components for each penetration firestopping system that are sufficiently flexible to accommodate movement, such as pipe vibration, water hammer, thermal expansion, and other normal building movement without damage.
 - 5. Provide components for each penetration firestopping system that are appropriately tested for the thickness and type of insulation utilized.
- C. Provide penetration firestopping systems that resist spread of fire, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- D. Penetration Firestopping Systems in Fire-Resistance-Rated Walls: Systems with ratings determined in accordance with ASTM E814 or UL 1479.
 - 1. F-Rating: Not less than the fire-resistance rating of the wall assembly penetrated.
 - 2. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.
 - 3. M-Rating: Provide penetration firestopping systems meeting specified F-Rating after being tested in accordance with ASTM E3037.

- E. Penetration Firestopping Systems in Horizontal Assemblies: Systems with ratings determined in accordance with ASTM E814 or UL 1479.
1. F-Rating: At least one hour, but not less than the fire-resistance rating of the floor/ceiling assembly penetrated.
 2. T-Rating: At least one hour, but not less than the fire-resistance rating of the floor/ceiling assembly. The following horizontal penetrations do not require a T-rating:
 - a. Those within the cavity of a wall.
 - b. Floor, tub, or shower drains within a concealed space.
 - c. 4-inch or smaller metal conduit penetrating directly into metal-enclosed electrical switchgear.
 3. W-Rating: Provide penetration firestopping systems with a Class 1 W-rating in accordance with UL 1479.
 4. M-Rating: Provide penetration firestopping systems meeting specified F-Rating being tested in accordance with ASTM E3037.
- F. Penetration Firestopping Systems in Smoke Barriers: Systems with ratings determined in accordance with UL 1479.
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.
 2. M-Rating: Provide penetration firestopping systems meeting specified L-Rating after being tested in accordance with ASTM E3037.
- G. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84 or UL 723.
1. Product Data: Verify architectural sealant has a VOC content of 250 g/L or less.
 2. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 4. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify the building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

2.3 ACCESSORIES

- A. Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated, including but not limited to:
 - 1. Permanent forming/damming/backing materials.
 - 2. Substrate primers.
 - 3. Collars.
 - 4. Steel sleeves.

2.4 FILL MATERIALS

- A. Cast-in-Place Firestopping Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestopping Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric strips for use around combustible penetrants.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Compressible, removable, and reusable intumescent pillows encased in fire-retardant polyester or glass-fiber cloth. Where exposed, and when required by a listed system, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed or dislodged.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.
- K. Thermal and Endothermic Wraps: Flexible, insulating, and fire-resistant protective wraps tested and listed for up to 2-hour fire ratings in accordance with ASTM E814 or UL 1479; for

protecting membrane penetrations of utility boxes, critical electrical circuits, communications lines, and fuel lines, and for thermal barrier and circuit integrity protection in accordance with ASTM E1725 or UL 1724.

- L. Fire-Rated Cable Sleeve Kits: Complete kits designed for new or existing cable penetrations through walls which accept standard accessories.
- M. Fire-Rated Cable Pathways: Single or gangable device modules composed of a steel raceway with integral intumescent material and requiring no additional action in the form of plugs, twisting closure, putty, pillows, sealant, or otherwise to achieve fire and air-leakage ratings.
 - 1. Fire-rated cable pathway devices are the preferred product for data, video, and communications cable penetrations. Install these devices in locations where frequent cable moves, add-ons, and changes will occur. Such devices must be:
 - a. Capable of retrofit around existing cables.
 - b. Designed so that two or more devices can be ganged together.
 - c. Maintenance-free so no action is required to activate the smoke- and fire-sealing mechanism.
 - 2. Where fire-rated cable pathway devices are not practical, openings within walls and floors designed to accommodate data, video, and communications cabling must be provided with re-enterable products specifically designed for retrofit, such as retrofit devices for cable bundles, firestopping putty, plugs, or pillows.
- N. Retrofit Device for Cable Bundles: Factory-made, intumescent, collar-like device for firestopping existing over-filled cable sleeves and capable of being installed around projecting sleeves and cable bundles.
- O. Wall-Opening Protective Materials: Intumescent, non-curing putty pads or self-adhesive inserts for protection of electrical switch and receptacle boxes.
- P. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestopping gasket for use around rectangular steel HVAC ducts without fire dampers.
- Q. Firestopping Plugs: Flexible, re-enterable, intumescent, foam-rubber plug for use in blank round openings and cable sleeves.
- R. Fire-Rated Cable Grommet: Molded two-piece grommet made of plenum-grade polymer and foam inner core for sealing small cable penetrations in gypsum walls up to 1/2 inch in diameter.
- S. Closet Flange Gasket: Molded, single-component, flexible, intumescent gasket for use beneath a water closet (toilet) flange in floor applications.

2.5 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer

speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings in accordance with manufacturer's written instructions and with the following requirements:
 - 1. Remove foreign materials from substrate surfaces that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates in accordance with penetration firestopping system manufacturer's written installation instructions, using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION OF PENETRATION FIRESTOPPING SYSTEMS

- A. General: Install penetration firestopping systems in accordance with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve required fire-resistance ratings.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 078443

JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated construction.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
2. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

- B. Unlisted Firestopping Systems: Obtain an Engineering Judgment (EJ) from firestop manufacturer where no UL, FM Approvals, or other listed assembly is available for particular firestop configuration. Follow International Firestop Council (IFC) recommended guidelines for evaluating firestop systems in EJs.

- C. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an EJ or equivalent fire-resistance-rated assembly developed in accordance with current IFC guidelines.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Listed System Designs: For each joint firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written installation instructions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approvals in accordance with FM Approvals 4991 or been evaluated by UL and found to comply with UL's "UL Solutions Qualified Firestop Contractor Program."

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems in accordance with manufacturer's written installation instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed in accordance with specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint firestop systems for each type of joint opening indicated from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. A qualified testing agency, acceptable to authorities having jurisdiction, will perform joint firestopping system tests.
2. Test in accordance with testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with listed system designs published by a qualified testing agency.
 - 1) UL in its online directory "Product iQ."

B. Rain/Water Resistance: For perimeter fire-barrier system applications, where inclement weather or greater-than-transient water exposure is expected, use products that dry rapidly and cure in the presence of atmospheric moisture sufficient to pass ASTM D6904 early rain-resistance test (24-hour exposure).

2.3 JOINT FIRESTOPPING SYSTEM TYPES

A. General: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems must accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

1. Joint firestopping systems that are compatible with one another, with the substrates forming openings, and with penetrating items, if any.
2. Provide products that, upon curing, do not re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture.
3. Provide firestop products that do not contain ethylene glycol.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined in accordance with ASTM E1966 or UL 2079, with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the fire-resistive joint system to restrict the movement of smoke.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Building and Construction
 - b. ClarkDietrich
 - c. Hilti, Inc.
 - d. Owens Corning
 - e. Tremco Incorporated
2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor,

or roof in or between which it is installed.

- C. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined in accordance with ASTM E84.

2.4 ACCESSORIES

- A. Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing joint firestopping systems, clean joints in accordance with fire-resistive joint system manufacturer's written installation instructions and the following requirements:
 - 1. Remove foreign materials from substrate surfaces that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates in accordance with joint firestopping system manufacturer's written installation instructions, using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Apply a suitable bond breaker to prevent three-sided adhesion in applications where condition occurs.

3.3 INSTALLATION

- A. General: Install joint firestopping systems in accordance with manufacturer's written installation instructions and published drawings for products and applications indicated.

- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
 - 1. Apply elastomeric fill in voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 - 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections in accordance with ASTM E2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.5 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

3.6 JOINT FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's indicated in the documents.

END OF SECTION 078443

SECTION 07 92 00 PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - A. Expansion joints within portland cement concrete pavement.
- B. Related Sections include the following:
 - 1. Section 03 30 00: "Cast-in-place Concrete" for constructing joints in concrete paving.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated with color selection chart. Color to be selected by Landscape Architect.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degrees F.
 - 2. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than that allowed by joint sealant manufacturer for application indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer based on testing and field experience.
- B. Products: Subject to compliance with requirements, provide the following or approved equal:
 - 1. Cold-applied multi-component sealant for concrete, complying with ASTM C-920, Type M, Class 25 or F.S. TT-S-0027E, Type 1, Class A:
 - A. Sika Sikaflex 2C/SL, Architect to select color.

2.2 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.
 - 1. Closed cell backer rod by Noamco or equal, sized to fit the joint width.

2.3 PRIMERS

- A. Primers: Product recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions applicable to products and applications indicated, unless more stringent requirements apply. Apply 1/2" minimum sealant depth.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.
 - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

- D. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Provide joint configuration to comply with joint sealant manufacturer's written instructions, unless otherwise indicated.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 07 92 00

SECTION 081113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standard steel doors and frames.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Interior standard steel doors and frames.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, core descriptions, fire-resistance

ratings, and finishes.

- C. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 7. Details of anchorages, joints, field splices, and connections.
 - 8. Details of accessories.
 - 9. Details of moldings, removable stops, and glazing.
- D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For door inspector.
 - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
 - 2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
- B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly and fire-rated borrowed-lite assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.
- C. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.
- D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.8 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies is to meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.
 - B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies is to meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.
- 1.9 DELIVERY, STORAGE, AND HANDLING
- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 1. Provide additional protection to prevent damage to factory-finished units.
 - B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
 - C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 HOLLOW METAL DOORS AND FRAMES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Ceco Door; AADG, Inc.; ASSA ABLOY
 2. Curries, AADG, Inc.; ASSA ABLOY Group
 3. Republic Doors and Frames; a Allegion brand

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
 1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.
 2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies,

provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

3. Temperature-Rise Limit: Where indicated on Drawings, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.
- C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.50 deg Btu/F x h x sq. ft. when tested in accordance with ASTM C1363 or ASTM E1423.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.
 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Core: Manufacturer's standard.
 - g. Fire-Rated Core: Manufacturer's standard vertical steel stiffener core for fire-rated doors.
 2. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Full profile welded.
 3. Exposed Finish: Prime.

2.4 BORROWED LITES

- A. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch.
- B. Construction: Full profile welded.

- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
 - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.
- D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- E. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting

of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

- F. Glazing: Comply with requirements in Section 088000 "Glazing."

2.7 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.
1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 4. Coordinate rabbet width between fixed and removable stops with glazing and installation

- types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
 3. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 4. Solidly pack mineral-fiber insulation inside frames.

5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
 2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
 3. Smoke-Control Doors: Install doors in accordance with NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Design Professional.
- B. Inspections:
1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.

3.4 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 083113

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flush access doors with exposed flanges.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.

B. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.4 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Babcock-Davis

- b. JL Industries; Activar Construction Products Group, Inc.
- c. Larsen's Manufacturing Company

- 2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
- 3. Locations: Wall and ceiling.
- 4. Door Size: As indicated on the drawings.
- 5. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
- 6. Frame Material: Same material, thickness, and finish as door.
- 7. Latch and Lock: Cam latch, screwdriver operated.

2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- D. Latch and Lock Hardware:
 - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

2.4 FINISHES

- A. Comply with NAAMM/NOMMA AMP 500 for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ACCESS DOORS AND FRAMES

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 084213

ALUMINUM-FRAMED ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed entrance door systems.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Aluminum-framed entrance door systems.

B. Product Data Submittals: For each product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories.

C. Shop Drawings:

1. Plans, elevations, sections, full-size details, and attachments to other work.
2. Details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
3. Full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrance door systems, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
4. Connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
5. Point-to-point wiring diagrams showing the following:

- a. Power requirements for each electrically operated door hardware.
 - b. Location and types of switches, signal device, conduit sizes, and number and size of wires.
- 6. Signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- F. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- G. Delegated Design Submittals: For aluminum-framed entrances and storefront systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: For aluminum-framed entrance door systems, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance.
- B. Product Test Reports: For aluminum-framed entrance door systems, for tests performed by a qualified testing agency.
- C. Qualification Statements:
 - 1. For Installer and egress door inspector.
- D. Delegated Design Engineer Qualifications: For aluminum-framed entrance and storefront systems.
- E. Sample Warranties: For aluminum-framed entrance door systems.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For aluminum-framed entrance door systems.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Fabricator of products.
- B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.
- C. Egress Door Inspector Qualifications:
 - 1. Inspector for field quality-control inspections of egress door assemblies to comply with qualifications set forth in NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Design Professional , except with Design Professional 's approval. If changes are proposed, submit comprehensive explanatory data to Design Professional for review.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrance door systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of doors.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain all components of aluminum-framed entrance door systems, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrance door systems.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance door systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- C. Structural Loads:
1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
- D. Structural: Test in accordance with ASTM E330/E330M as follows:
1. When tested at 150 percent of positive and negative wind-load design pressures, entrance doors, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 2. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas of entrance doors when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
- F. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):

- a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.41 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
 - b. Entrance Doors: U-factor of not more than 0.68 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
2. Solar Heat-Gain Coefficient (SHGC):
- a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.40 as determined in accordance with NFRC 200.
 - b. Entrance Doors: SHGC of not more than 0.40 as determined in accordance with NFRC 200.
3. Air Leakage:
- a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.
 - b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
4. Condensation Resistance Factor (CRF):
- a. Fixed Glazing and Framing Areas: CRF for the system of not less than 35 as determined in accordance with AAMA 1503.
 - b. Entrance Doors: CRF of not less than 57 as determined in accordance with AAMA 1503.

G. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 ALUMINUM-FRAMED ENTRANCE DOOR SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. EFCO Corporation
 2. Kawneer Company, Inc.; Arconic Corporation
 3. Trulite Glass & Aluminum Solutions, LLC.
 4. Tubelite Inc.
 5. U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.
 6. YKK AP America Inc.
- B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with

reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

- a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
2. Door Design: As indicated.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
4. Door Finish: Baked-enamel or powder-coat finish.
- C. Framing Members: Manufacturer's standard extruded aluminum, minimum 0.125 inch thick and reinforced as required to support imposed loads.
 1. Nominal Size: As indicated on Drawings.
 2. Exterior Framing Construction: Thermally broken.
 3. Interior Vestibule Framing Construction: Nonthermal.
 4. Finish: Match door finish.
- D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- F. Materials:
 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
 - c. Structural Profiles: ASTM B308/B308M.
 2. Steel Reinforcement:
 - a. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
 3. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.4 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

2.5 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

2.6 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.
- E. Rigid PVC filler.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms.
- F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.8 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
1. Color and Gloss: As indicated on the drawings..

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOOR SYSTEMS

- A. Comply with manufacturer's written instructions.

- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.
- K. Install entrance doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
- L. Install glazing as specified in Section 088000 "Glazing."

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections.
- B. Inspections:
 - 1. Egress Door Inspections: Inspect each aluminum-framed entrance door equipped with panic hardware, located in an exit enclosure, electrically controlled, and equipped with special locking arrangements, in accordance with NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
- C. Aluminum-framed entrance door systems will be considered defective if they do not pass tests and inspections.

END OF SECTION 084213

SECTION 084313

ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.

B. Related Requirements:

1. Section 081116.13 "Interior Aluminum Doors and Frames" for interior aluminum framing.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: For aluminum-framed storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
3. Show connection to and continuity with adjacent thermal, weather, air, and vapor

barriers.

- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- F. Delegated Design Submittal: For aluminum-framed storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For professional engineer's experience with providing delegated design engineering services of the type indicated, including documentation that engineer is licensed in the state in which Project is located.
- B. Energy Performance Certificates: For aluminum-framed storefronts, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed storefront.
- C. Product Test Reports: For aluminum-framed storefronts, for tests performed by a qualified testing agency.
- D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed storefronts 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 and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.
- B. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025 and acceptable to Engineer and Design Professional.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Design Professional, except with Design Professional's approval. If changes are proposed, submit comprehensive explanatory data to Design Professional for review.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 1. Aluminum-framed storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
- C. Structural Loads:
 1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 1. Deflection Normal to Wall Plane: Limited to 1/175 of length of span of the framing member for lengths of up to 13 feet 6 inches and to 1/240 of length of span of the framing member plus 1/4 inch for lengths greater than 13 feet 6 inches.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
 1. When tested at positive and negative wind-load design pressures, storefront assemblies do not evidence deflection exceeding specified limits.

2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
- G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
 2. Maximum Water Leakage: In accordance with AAMA 501.1. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- H. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.36 BTU/sq. ft. x h x deg F as determined in accordance with NFRC 100.
 2. Solar Heat Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.40 as determined in accordance with NFRC 200.
 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.
 4. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 35 as determined in accordance with AAMA 1503.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.

- a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
- b. Low Exterior Ambient-Air Temperature: 0 deg F.
- c. Interior Ambient-Air Temperature: 75 deg F.

2.2 ALUMINUM-FRAMED STOREFRONT SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. EFCO Corporation
 - 2. Kawneer Company, Inc.; Arconic Corporation
 - 3. Trulite Glass & Aluminum Solutions, LLC.
 - 4. Tubelite Inc.
 - 5. U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.
 - 6. YKK AP America Inc.
- B. Source Limitations: Obtain all components of aluminum-framed storefront system, including framing spandrel panels and accessories, from single manufacturer.
- C. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Exterior Framing Construction: Thermally broken.
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: Front.
 - 4. Finish: Baked-enamel or powder-coat finish As indicated on the drawings.
 - 5. Fabrication Method: Field-fabricated stick system.
 - 6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 7. Steel Reinforcement: As required by manufacturer.
- D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.3 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.

2.4 MATERIALS

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.5 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.
- E. Rigid PVC Filler.

2.6 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration

of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.7 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: As indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.

- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088000 "Glazing."

3.4 INSTALLATION OF WEATHERSEAL SEALANT

- A. Install weatherseal sealant to completely fill cavity, according to sealant manufacturer's written instructions, to produce weatherproof joints.

3.5 ERECTION TOLERANCES

- A. Install aluminum-framed storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 084313

SECTION 085113
ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum windows.

1.2 DEFINITIONS

- A. Combination Assemblies: An assembly formed by a combination of two or more separate fenestration products whose frames are mullied together utilizing a combination mullion or reinforcing mullion.
- B. Combination Mullions: A horizontal or vertical member formed by joining two or more individual fenestration units together without a mullion stiffener.
- C. Reinforcing Mullions: A horizontal or vertical member with an added continuous mullion stiffener and joining two or more individual fenestration units along the sides of the mullion stiffener.

1.3 COORDINATION

- A. Finish Matching: Coordinate all exposed exterior aluminum components and trim to ensure uniform and consistent color and appearance. Use products specified in this Section as a benchmark. Design Professional's decision will be final as to whether a proposed product matches.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review and discuss finishing of aluminum windows that is required to be coordinated with finishing of other aluminum work for color and finish matching.
 - 3. Review, discuss, and coordinate interrelationship of aluminum windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
 - 4. Review and discuss sequence of work required to construct a watertight and weathertight

- exterior building envelope.
5. Inspect and discuss condition of substrate and other preparatory work performed by other trades.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes.
- B. Shop Drawings:
 1. Plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.
- D. Samples for Verification: Actual sample of finished products for each type of exposed finish:
 1. Exposed Aluminum Finishes: Manufacturers' standard size.
 2. Exposed Hardware: Full-size units.
- E. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

- A. Test and Evaluation Reports:
 1. Product Test Reports: For each aluminum window, for tests performed by qualified testing agency.
- B. Qualification Statements: For manufacturer and Installer.
- C. Sample warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Warranty Documentation:
 1. Manufacturers' special warranties.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that

meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

- B. Installer Qualifications: Authorized representative who is trained and approved by aluminum window manufacturer.
- C. Testing Agency Qualifications: An FGIA-accredited testing agency for testing indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver aluminum windows to Project site in original, unopened packages and store them in accordance with manufacturer's written instructions. Protect aluminum windows against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Handle aluminum windows in a manner that prevents damage before, during, and after installation.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install aluminum windows outside of limits recommended in writing by manufacturer.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Failure to meet performance requirements.
- b. Structural failures, including excessive deflection, water leakage, condensation, and air infiltration.
- c. Faulty operation of movable sash and hardware.
- d. Deterioration of materials and finishes beyond normal weathering.
- e. Failure of insulating glass.

2. Warranty Period:

- a. Window: Five years from date of Substantial Completion.
- b. Glazing Units: Five years from date of Substantial Completion.
- c. Hardware: Three years from date of Substantial Completion.
- d. Aluminum Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain aluminum windows from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Window Certification: FGIA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance Class: AW.
 - 2. Minimum Performance Grade: 40.
 - 3. Mull Window Systems: Evaluate and rate combination assemblies as single systems as determined by AAMA 450 in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 requirements.
- C. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
 - 1. Thermal Transmittance (U-factor): As determined in accordance with NFRC 100:
 - a. Fixed Windows: Not more than 0.42 Btu/sq. ft. x h x deg F.
 - b. Operable Windows: Not more than 0.45 Btu/sq. ft. x h x deg F.
 - 2. Solar Heat-Gain Coefficient (SHGC): As determined in accordance with NFRC 200:
 - a. Fixed Windows: Not more than 0.40.
 - b. Operable Windows: Not more than 0.40 as determined in accordance with NFRC 200.
 - 3. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance in accordance with AAMA 1503, showing a CRF of 45.
- D. Thermal Movements: Provide aluminum windows, including anchorage, which allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

2.3 ALUMINUM WINDOWS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. EFCO Corporation
 - 2. Graham Design Professional Products Corporation
 - 3. Kawneer Company, Inc.; Arconic Corporation
 - 4. Wausau Window and Wall Systems; Apogee Wausau Group, Inc.
 - 5. YKK AP America Inc.
- B. Provide manufacturer's standard aluminum window assemblies consisting of frames, sashes, glass, hardware, fasteners, and all components and accessories as required for a complete installation.
- C. Operating Types: Provide the following operating types in locations indicated on Drawings:
 - 1. Fixed.
- D. Frames and Sashes: Aluminum extrusions of alloy, temper, and strength complying with AAMA/WDMA/CSA 101/I.S.2/A440.
 - 1. Thermally Broken Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.
- E. Glass:(GL-3T) Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.
 - 1. Kind: Fully tempered .
- F. Insulating-Glass Units: ASTM E2190.
 - 1. Glass: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: Clear.
 - b. Kind: Fully tempered .
 - 2. Lites: Two.
 - 3. Filling: Fill space between glass lites with argon.
 - 4. Low-E Coating: Sputtered on second surface.
- G. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.
 - 1. Dual Glazing System:
 - a. Interior Lite: Glass.
 - b. Exterior Lite: Insulating-glass unit.

- H. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
 - 1. Exposed Hardware Color and Finish: As selected by Design Professional from manufacturer's full range.
- I. Window Hardware: Casement.
 - 1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested in accordance with ASTM E405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.
 - a. Type and Style: As selected by Design Professional from manufacturer's full range of types and styles.
 - 2. Hinges: Non-friction type, not less than two per sash.
 - 3. Lock: Lift-type throw, cam-action lock with keeper.
 - 4. Limit Devices: Concealed friction adjustor, adjustable stay bar limit devices designed to restrict sash opening.
 - a. Limit clear opening to 4 inches for ventilation; with custodial key release.
- J. Weather Stripping: Provide manufacturer's standard full-perimeter weather stripping for each operable sash unless otherwise indicated.
- K. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Avoid exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
- L. Mullions: Provide manufacturer's standard combination and reinforcing mullions and cover plates matching window units, complete with anchors for support to structure. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide reinforcing mullions and cover plates capable of withstanding design wind loads of window units.

2.4 ACCESSORIES

- A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.
- B. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- C. Panning Trim: Profiles in sizes and configurations indicated on Drawings.
- D. Nail Fins: Manufacturer's standard mounting flanges with holes pre-punched for mechanical

fasteners.

2.5 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Glaze aluminum windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.
- F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA AMP 500 "Metal Finishes Manual for Design Professional and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: As indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, air and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Mullions: Install combination and reinforcing mullions for combination assemblies in accordance with manufacturer's written instructions.
- D. Install windows and components to drain water passing joints and condensation to the exterior.
- E. Separate aluminum from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

3.4 CLEANING AND PROTECTION

- A. Clean exposed surfaces immediately after installing windows using manufacturer's written instructions. Avoid damaging finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

- C. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 085113

SECTION 087100

DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components
3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 "General Requirements" sections for Allowances, Alternates, Engineer Furnished Contractor Installed, Project Management and Coordination.
2. Division 06 Section "Rough Carpentry"
3. Division 06 Section "Finish Carpentry"
4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:
 - a. "Metal Doors and Frames"
 - b. "Flush Wood Doors"
 - c. "Aluminum-Framed Entrances and Storefronts"
 - d. "Special Function Doors"
6. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
7. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
8. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
 - a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.
 - b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Samples for Verification: If requested by Design Professional, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Design Professional may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule:
 - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
 - b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
 - c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Design Professional's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each hardware set cross-referenced to indications on Drawings.
 - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for hardware.
 - 8) Door and frame sizes and materials.
 - 9) Degree of door swing and handing.
 - 10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.
5. Key Schedule:
 - a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
 - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.

- c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
- d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
- e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Engineer, by means as directed by Engineer.
- f. Prepare key schedule by or under supervision of supplier, detailing Engineer's final keying instructions for locks.

C. Informational Submittals:

- 1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
- 2. Provide Product Data:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - b. Include warranties for specified door hardware.

D. Closeout Submittals:

- 1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Final approved hardware schedule edited to reflect conditions as installed.
 - d. Final keying schedule
 - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
 - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

- 1. Submit written reports to the Engineer and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
 - a. Fire door assemblies, in compliance with NFPA 80.
 - b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Engineer, Design Professional, and Contractor, at reasonable times during the Work for consultation.
 2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
 3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 - a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Design Professional and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
 - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Design Professional and electrical engineers.
 4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- B. Certifications:
1. Fire-Rated Door Openings:
 - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
 - b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
 2. Smoke and Draft Control Door Assemblies:
 - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
 - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
 3. Electrified Door Hardware
 - a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
 4. Accessibility Requirements:

- a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference

- a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2) Preliminary key system schematic diagram.
 - 3) Requirements for key control system.
 - 4) Requirements for access control.
 - 5) Address for delivery of keys.

2. Pre-installation Conference

- a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- b. Inspect and discuss preparatory work performed by other trades.
- c. Inspect and discuss electrical roughing-in for electrified door hardware.
- d. Review sequence of operation for each type of electrified door hardware.
- e. Review required testing, inspecting, and certifying procedures.
- f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:

- a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Engineer.

1.06 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Engineer's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 - 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
 - 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
 - a. Mechanical Warranty
 - 1) Locks
 - a) Schlage L Series: 10 years
 - b) Schlage ND Series: 10 years
 - 2) Exit Devices
 - a) Von Duprin: 10 years
 - 3) Closers
 - a) LCN 4000 Series: 30 years
 - 4) Automatic Operators
 - a) LCN: 2 years
 - b. Electrical Warranty
 - 1) Exit Devices
 - a) Von Duprin: 3 years

- 2) Closers
 - a) LCN: 2 years

1.08 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Engineer for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The Engineer requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications.
- B. Approval of alternate manufacturers and/or products other than those listed in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Design Professional's approval.

2.02 MATERIALS

- A. Fabrication
 - 1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
 - 2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Design Professional where visible fasteners, such as thru bolts, are required.

- B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.
 - 1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
 - 2. Use materials which match materials of adjacent modified areas.
 - 3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.
- C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
 - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.
- D. Cable and Connectors:
 - 1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
 - 2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
 - 3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Ives 5BB series
- B. Requirements:
 - 1. Provide hinges conforming to ANSI/BHMA A156.1.
 - 2. Provide five knuckle, ball bearing hinges.
 - 3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
 - 4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
 - 5. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
9. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin EPT-10

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.07 TWO-POINT LOCK

A. Manufacturer and Product:

1. Scheduled Manufacturer and Product:
 - a. Schlage LM9200

B. Requirements:

1. Provide concealed two-point locking system for use in pair wood door applications manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
2. Concealed Vertical Locking Devices: Vertical latch system in two-point for non-rated or fire rated wood doors up to a 45-minute rating and less bottom latch (LBL) configuration for non-rated or fire rated wood doors up to 20-minute rating.
3. Provide electrified lockset functions as scheduled in the hardware sets.
4. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses or escutcheon as scheduled and external lever spring cages. Provide escutcheon trim which does not require the use of a backer plate in wood door applications. Provide thru-bolted levers with 2-piece spindles.
 - a. Lever Design: 17A.

2.08 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage ND series

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide escutcheon with lock status indicator window on top of lockset rose:
 - a. Escutcheon height (including rose) 6.05 inches high by 3.68 inches wide.
 - b. Indicator window measuring a minimum 3.52-inch by .60 inch with 1.92 square-inches of front facing viewing area and 180-degree visibility with a total of .236 square-inches of total viewable area.
 - c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
 - d. Provide messages color-coded with full text and symbol, as scheduled, for easy visibility.
 - e. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
3. Cylinders: Refer to "KEYING" article, herein.
4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Provide electrified options as scheduled in the hardware sets.
9. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 - a. Vandlgard: Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
 - b. Lever Design: Sparta 17.

2.09 HOSPITAL LATCHES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Schlage

B. Requirements:

1. Provide hospital latches conforming to ANSI/BHMA A156 with covers engraved "Push" and "Pull".

2. Provide proper latch throw for UL listing at pairs.
3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
4. Mount trim with push paddle mounted up and pull paddle mounted down except at psychiatric or security areas provide both paddles mounted down, unless noted otherwise.
5. Provide standard dampened paddle action – depression and snap back – reducing noise associated with lock operation

2.10 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin 99/33A series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide grooved touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer's approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Design Professional.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Provide electrified options as scheduled.
13. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
15. Special Options:
 - a. CVC
 - 1) Provide cable-actuated concealed vertical latch system in two-point for non-rated or fire rated wood doors up to a 90 minute rating and less bottom latch (LBL) configuration for non-rated or fire rated wood doors up to 20 minute rating. Vertical rods not permitted.
 - a) Cable: Stainless steel with abrasive resistant coating. Conduit and core wire ends snap into latch and center slides without use of tools.

- b) Wood Door Prep: Maximum 1 inch x 1.1875 inch x 3.875 inches top latch pocket and 1 inch x 1.1875 inch x 5 inches bottom latch pocket which does not require the use of a metal wrap or edge for non-rated or fire rated wood doors up to a 45 minute rating.
- c) Latchbolts and Blocking Cams: Manufactured from sintered metal low carbon copper- infiltrated steel, with molybdenum disulfide low friction coating.
- d) Top Latchbolt: Minimum 0.38 inch (10 mm) and greater than 90-degree engagement with strike to prevent door and frame separation under high static load.
- e) Bottom Latchbolt: Minimum of 0.44-inch (11 mm) engagement with strike.
- f) Product Cycle Life: 1,000,000 cycles.
- g) Latch Operation: Top and bottom latch operate independently of each other. Top latch fully engages top strike even when bottom latch is compromised. Separate trigger mechanisms not permitted.
- h) Latch release does not require separate trigger mechanism.
- i) Cable and latching system characteristics:
 - i. Installed independently of exit device installation, and capable of functioning on door prior to device and trim installation.
 - ii. Connected to exit device at single point in steel and aluminum doors, and two points for top and bottom latches in wood doors.
 - iii. Bottom latch height adjusted, from single point for steel and aluminum doors and two points for wood doors, after system is installed and connected to exit device, while door is hanging
 - iv. Bottom latch position altered up and down minimum of 2 inches (51 mm) in steel and aluminum doors without additional adjustment. Bottom latch deadlocks in every adjustment position in wood doors.
 - v. Top and bottom latches in steel and aluminum doors and top latch in wood doors may be removed while door is hanging.

2.11 ELECTRIC STRIKES

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product:
 - a. Locknetics

B. Requirements:

- 1. Provide electric strikes designed for use with type of locks shown at each opening.
- 2. Provide electric strikes UL Listed as burglary resistant.
- 3. Provide electric strikes that are field selectable fail-safe and fail-secure.
- 4. Provide electric strikes cycle tested to endure a minimum of 250,000 cycles.
- 5. Where required, provide electric strikes UL Listed for fire doors and frames.
- 6. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.12 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage/Von Duprin PS900 Series

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Design Professional.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:
 - a. 12/24 VDC Output, field selectable.
 - b. Class 2 Rated power limited output.
 - c. Universal 120-240 VAC input.
 - d. Low voltage DC, regulated and filtered.
 - e. Polarized connector for distribution boards.
 - f. Fused primary input.
 - g. AC input and DC output monitoring circuit w/LED indicators.
 - h. Cover mounted AC Input indication.
 - i. Tested and certified to meet UL294.
 - j. NEMA 1 enclosure.
 - k. Hinged cover w/lock down screws.
 - l. High voltage protective cover.

2.13 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage Everest 29 SL

B. Requirements:

1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
 - a. Patented Restricted 7-Pin: cylinder with permanent 7-pin core with keys capable of working in full size key-in-lever/knob, and small format interchangeable core.

3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent protected.
4. Nickel silver bottom pins.

2.14 KEYING

A. Scheduled System:

1. New factory registered system:
 - a. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference. Contact:
 - 1) Firm Name: Allegion
 - 2) Contact Person: Riley Landrum
 - 3) Telephone: 937-751-6980

B. Requirements:

1. Construction Keying:
 - a. Replaceable Construction Cores.
 - 1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - a) 3 construction control keys
 - b) 12 construction change (day) keys.
 - 2) Engineer or Engineer's Representative will replace temporary construction cores with permanent cores.
2. Permanent Keying:
 - a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - 1) Master Keying system as directed by the Engineer.
 - b. Forward bitting list and keys separately from cylinders, by means as directed by Engineer. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Engineer.
 - c. Provide keys with the following features:
 - 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
 - 3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.
 - d. Identification:
 - 1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
 - 2) Identification stamping provisions must be approved by the Design Professional and Engineer.
 - 3) Stamp cylinders/cores and keys with Engineer's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.

- 4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Engineer.
- 5) Forward permanent cylinders/cores to Engineer, separately from keys, by means as directed by Engineer.
- e. Quantity: Furnish in the following quantities.
 - 1) Permanent Control Keys: 3.
 - 2) Master Keys: 6.
 - 3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
 - 4) Key Blanks: Quantity as determined in the keying meeting.

2.15 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN 4040XP series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.
11. Closers shall be capable of being upgraded by adding modular mechanical or electronic components in the field.

2.16 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN 4600 series

B. Requirements:

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide drop plates, brackets, and adapters for arms as required for details.
6. Provide actuator switches and receivers for operation as specified.
7. Provide weather-resistant actuators at exterior applications.
8. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to "KEYING" article, herein.
9. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Design Professional. Locate actuators, key switches, and other controls as directed by Design Professional.
10. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.17 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.18 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Size plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.19 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:
 - a. Glynn-Johnson

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.20 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button or thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.21 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Zero International

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.22 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.23 LATCH PROTECTORS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives

- B. Provide stainless steel latch protectors of type required to function with specified lock.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Where on-site modification of doors and frames is required:
 - 1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
 - 2. Field modify and prepare existing doors and frames for new hardware being installed.
 - 3. When modifications are exposed to view, use concealed fasteners, when possible.
 - 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
 - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
 - 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- I. Lock Cylinders:
 - 1. Install construction cores to secure building and areas during construction period.
 - 2. Replace construction cores with permanent cores as indicated in keying section.
- J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Design Professional.
 - 5. Connections to panel interface modules, controllers, and gateways.
 - 6. Testing and labeling wires with Design Professional's opening number.
- K. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.
- L. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Design Professional.
- M. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- N. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Design Professional.

- O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- S. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 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.
 - 1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.05 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the Design Professional 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.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets:

Abbreviation	Name
B/O	By Others
DON	Don-Jo Manufacturing, Inc.
GLY	Glynn-Johnson Corp
IVE	H.B. Ives
LCN	LCN Commercial Division
LOC	Locknetics Security Engineering
SCE	Schlage Electronic Security
SCH	Schlage Lock Company
VON	Von Duprin
ZER	Zero International Inc

131715 OPT0422342 Version 1

Hardware Set No. 01

For use on mark/door #(s):

103-1

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HDWE	99-L-BE-F-17	626	VON
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

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Hardware Set No. 02

For use on mark/door #(s):

109-1

Each to have:

6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CONST LATCHING BOLT	FB51T	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96JD SPA	626	SCH
1	EA	FSIC CORE	91-161 EV B	626	SCH
1	EA	OH STOP	450S	689	GLY
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	OVERLAPPING ASTRAGAL	PROVIDED BY DR MANFG.	600	B/O
2	EA	SILENCER	SR64	GRY	IVE

Hardware Set No. 03

For use on mark/door #(s):

111-1 111-2 116-1 117-1 117-2

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 8" X 16"	630	IVE
1	EA	PULL PLATE	8305 10" 4" X 16" F	630	IVE
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

REGULAR ARM MOUNTED DOOR CLOSER - INSTALL DOOR CLOSER ON PULL SIDE OF THE DOOR.

Hardware Set No. 04

For use on mark/door #(s):

111-3 117-3 120-2

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH/PULL LATCH	HL6 E1 3 3/4" B (AT 45" AFF)	626	SCH
1	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

Hardware Set No. 05

For use on mark/door #(s):

113-2

Each to have:

6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HDWE	9949-L-BE-F-17	626	VON
1	EA	FIRE EXIT HDWE	9949-L-BE-F-17-LBLAFL	626	VON
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	KICK PLATE	8400 8" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	MEETING STYLE	8217SBK PSA	BK	ZER

Hardware Set No. 06

For use on mark/door #(s):

113-3

Each to have:

6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	PUSH BAR W/PULL	330-DT-990	626	VON
1	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	KICK PLATE	8400 8" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

Hardware Set No. 07

For use on mark/door #(s):

117-4

Each to have:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96JD SPA	626	SCH
1	EA	FSIC CORE	91-161 EV B	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

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Operations Building Renovation

Hardware Set No. 08

For use on mark/door #(s):

120-1

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH/PULL LATCH	HL6 E1 3 3/4" B (AT 45" AFF)	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP REG ARM ST-1630	689	LCN
1	EA	MOUNTING PLATE	4040XP-18TJ SRT	689	LCN
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

Hardware Set No. 09

For use on mark/door #(s):

123-1

Each to have:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	VANDL OFFICE LOCK	ND91JD SPA	626	SCH
1	EA	FSIC CORE	91-161 EV B	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Set No. 10

For use on mark/door #(s):

124-1

124-2

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	VANDL OFFICE LOCK	ND91JD SPA	626	SCH
1	EA	FSIC CORE	91-161 EV B	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP REG ARM ST-1630	689	LCN
1	EA	MOUNTING PLATE	4040XP-18TJ SRT	689	LCN
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Set No. 11

For use on mark/door #(s):

204-1

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HDWE	99-L-BE-F-17	626	VON
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

REGULAR ARM MOUNTED DOOR CLOSER - INSTALL DOOR CLOSER ON PULL SIDE OF THE DOOR.

Hardware Set No. 12

For use on mark/door #(s):

206-1

206-2

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	VANDL ENTRANCE LOCK	ND92JD SPA	626	SCH
1	EA	FSIC CORE	91-161 EV B	626	SCH
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Set No. 13

For use on mark/door #(s):

214-1

217-1

218-1

221-1

222-1

Each to have:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	VANDL OFFICE LOCK	ND91JD SPA	626	SCH
1	EA	FSIC CORE	91-161 EV B	626	SCH
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Set No. 14

For use on mark/door #(s):

215-1

Each to have:

6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	TWO PT CLASSRM LOCK	LM9270J 17A LBL	626	SCH
2	EA	FSIC CORE	91-161 EV B	626	SCH
2	EA	OH STOP	100S	630	GLY
2	EA	SURFACE CLOSER	4040XP REG ARM ST-1630	689	LCN
1	EA	MOUNTING PLATE	4040XP-18TJ SRT	689	LCN
2	EA	KICK PLATE	8400 8" X 1" LDW B-CS	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

Hardware Set No. 15

For use on mark/door #(s):

223-1

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY W/IND	ND40S SPA OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Set No. AC-01
For use on mark/door #(s):

X104-1

Each to have:

2	E	CONT. HINGE	112XY EPT	711	IVE
	A				
2	E	POWER TRANSFER	EPT10 CON	622	VON
	A				
1	E	ELEC PANIC HDWE	SD-RX-QEL-9949-EO-CON 24 VDC	711	VON
	A				
1	E	ELEC PANIC HDWE	SD-RX-QEL-9949-NL-OP-110MD-CON 24 VDC	693/711	VON
	A				
2	E	SFIC MORTISE CYL.	80-110 X XQ11-948 36-083 36-082-025	622	SCH
	A				
1	E	SFIC RIM CYLINDER	80-116	622	SCH
	A				
3	E	FSIC CORE	91-161 EV B	622	SCH
	A				
2	E	OH STOP	100S	BLK	GLY
	A				
2	E	SURFACE CLOSER	4040XP	622	LCN
	A				
2	E	MOUNTING PLATE	4040XP-18G SRT	693	LCN
	A				
2	E	DOOR SWEEP	8197BK	BK	ZER
	A				
1	E	THRESHOLD	655BK-223	BK	ZER
	A				
2	E	WIRE HARNESS	CON-26P		SCH
	A				
2	E	WIRE HARNESS	CON-6W		SCH
	A				
1	E	POWER SUPPLY	PS902 BBK 900-2RS 120/240 VAC	LGR	SCE
	A				
1	E	CREDENTIAL READER	PROVIDED BY SECURITY CONTR.		B/O
	A				
2	E	DR POSITION SWITCH	PROVIDED BY SECURITY CONTR.		B/O
	A				

PROVIDE HARDWARE FOR ALUMINUM DOORS UNDER THIS SECTION. DELIVER HARDWARE TEMPLATES AND HARDWARE, EXCEPT FIELD APPLIED HARDWARE, TO THE ALUMINUM DOOR AND FRAME MANUFACTURER FOR USE IN FABRICATING DOORS AND FRAMES.

PERIMETER WEATHER AND MEETING STYLE SEALS PROVIDED BY ALUMINUM SECTION. TOP JAMB ARM MOUNTED DOOR CLOSER - INSTALL DOOR CLOSER ON PUSH SIDE OF THE DOOR.

DESCRIPTION OF OPERATION:

PRESENTING VALID CREDENTIAL TO READER AND/OR REMOTE RELEASE BUTTON WILL RETRACT LATCHES FOR ACCESS.

EMERGENCY ACCESS BY MECHANICAL KEY OVERRIDE.

REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE FOR USE BY ACCESS CONTROL CONTRACTOR.

FREE EGRESS AT ALL TIMES.

Hardware Set No. AC-02
For use on mark/door #(s):

X113-1

Each to have:

2	E	CONT. HINGE	112XY EPT	711	IVE
	A				
2	E	POWER TRANSFER	EPT10 CON	622	VON
	A				
1	E	ELEC PANIC HDWE	SD-RX-QEL-9949-EO-CON 24 VDC	711	VON
	A				
1	E	ELEC PANIC HDWE	SD-RX-QEL-9949-NL-OP-110MD-CON 24 VDC	693/711	VON
	A				
2	E	SFIC MORTISE CYL.	80-110 X XQ11-948 36-083 36-082-025	622	SCH
	A				
1	E	SFIC RIM CYLINDER	80-116	622	SCH
	A				
3	E	FSIC CORE	91-161 EV B	622	SCH
	A				
2	E	OH STOP	100S	BLK	GLY
	A				
1	E	SURFACE CLOSER	4040XP	622	LCN
	A				
1	E	AUTO OPERATOR	4642 WMS 120 VAC	693	LCN
	A				
1	E	MOUNTING PLATE	4040XP-18G SRT	693	LCN
	A				
1	E	WEATHER RING	8310-801		LCN
	A				
2	E	ACTUATOR, TOUCH	8310-853T	630	LCN
	A				
2	E	DOOR SWEEP	8197BK	BK	ZER
	A				
1	E	THRESHOLD	655BK-223	BK	ZER
	A				
2	E	WIRE HARNESS	CON-26P		SCH
	A				
2	E	WIRE HARNESS	CON-6W		SCH
	A				
1	E	POWER SUPPLY	PS902 BBK 900-4RL 120/240 VAC	LGR	SCE
	A				
1	E	CREDENTIAL	PROVIDED BY SECURITY CONTR.		B/O
	A	READER			
2	E	DR POSITION	PROVIDED BY SECURITY CONTR.		B/O
	A	SWITCH			

PROVIDE HARDWARE FOR ALUMINUM DOORS UNDER THIS SECTION. DELIVER HARDWARE TEMPLATES AND HARDWARE, EXCEPT FIELD APPLIED HARDWARE, TO THE ALUMINUM DOOR AND FRAME MANUFACTURER FOR USE IN FABRICATING DOORS AND FRAMES.

PERIMETER WEATHER AND MEETING STYLE SEALS PROVIDED BY ALUMINUM SECTION. TOP JAMB ARM MOUNTED DOOR CLOSER - INSTALL DOOR CLOSER ON PUSH SIDE OF THE DOOR.

DESCRIPTION OF OPERATION:

PRESENTING VALID CREDENTIAL TO READER AND/OR REMOTE RELEASE BUTTON WILL RETRACT LATCHES AND TURN ON ADA ACTUATOR FOR ACCESS. PRESSING ADA WALL ACTUATOR WILL OPEN THE DOOR.

EMERGENCY ACCESS BY MECHANICAL KEY OVERRIDE.

REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE FOR USE BY ACCESS CONTROL CONTRACTOR.

FREE EGRESS AT ALL TIMES.

Hardware Set No. EX-AC-01

For use on mark/door #(s):

102-2 102-3

Each to have:

1	EA	VANDL STOREROOM LOCK	ND96JD SPA	626	SCH
1	EA	FSIC CORE	91-161 EV B	626	SCH
1	EA	ELECTRIC STRIKE	NC450-LBM 12/24 VDC	630	LOC
1	EA	LOCK GUARD	LG14	630	IVE
1	EA	POWER SUPPLY	PROVIDED BY SECURITY CONTR.		B/O
1	EA	CREDENTIAL READER	PROVIDED BY SECURITY CONTR.		B/O
1	EA	DR POSITION SWITCH	PROVIDED BY SECURITY CONTR.		B/O

BALANCE OF HARDWARE EXISTING

FIELD PREP EXISTING DOOR/FRAME TO ACCEPT NEW DOOR HARDWARE.

Hardware Set No. EX-AC-02

For use on mark/door #(s):

X125-1 X133-2

Each to have:

1	EA	VANDL STOREROOM LOCK	ND96JD SPA	626	SCH
1	EA	FSIC CORE	91-161 EV B	626	SCH
1	EA	ELECTRIC STRIKE	NC450-LBM 12/24 VDC	630	LOC
1	EA	LOCK GUARD	LG14	630	IVE
1	EA	MENDING PLATE	14-2-CW	630	DON
1	EA	POWER SUPPLY	PROVIDED BY SECURITY CONTR.		B/O
1	EA	CREDENTIAL READER	PROVIDED BY SECURITY CONTR.		B/O
1	EA	DR POSITION SWITCH	PROVIDED BY SECURITY CONTR.		B/O

BALANCE OF HARDWARE EXISTING

FIELD PREP EXISTING DOOR/FRAME TO ACCEPT NEW DOOR HARDWARE.

END OF SECTION 087100

SECTION 088000

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 085113 "Aluminum Windows" for glazing in aluminum windows.

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
 1. Insulating glass.
 2. Spandrel glass.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturers of fabricated glass units and sealant testing agency.
- B. Product Certificates: For glass.
- C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.
 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.
- B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.
- C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of

insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations for Glass: Obtain coated glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
 1. Design Wind Pressures: As indicated on Drawings.
 2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 1. IGM Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
 1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cardinal Glass Industries, Inc.
 - b. Guardian Glass LLC
 - c. Pilkington North America; NSG Group
 - d. Saint-Gobain Glass Corp
 - e. Vitro Architectural Glass

- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cardinal Glass Industries, Inc.
 - b. Guardian Glass LLC
 - c. Pilkington North America; NSG Group
 - d. Saint-Gobain Glass Corp
 - e. Vitro Architectural Glass
- D. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.
- E. Reflective- and Low-E-Coated Spandrel Glass: ASTM C1376, Kind CS.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 - 2. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: As selected by Design Professional from manufacturer's full range of industry colors.
- B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Pecora Corporation
- b. Sika Corporation
- c. The Dow Chemical Company
- d. Tremco Incorporated

2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 - 1. AAMA 804.3 tape, where indicated.
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
 - 1. Type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
 - 1. Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:
 - 1. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant

performance.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in

referenced glazing publications.

- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

- A. Clear Glass Type GL-1T: Fully tempered float glass.
 - 1. Minimum Thickness: 6 mm.
 - 2. Safety glazing required.

3.9 INSULATING GLASS SCHEDULE

- A. Low-E-Coated, Clear Insulating Glass Type GL-2T:
 - 1. Overall Unit Thickness: 1 inch.
 - 2. Minimum Thickness of Each Glass Lite: 6 mm.
 - 3. Outdoor Lite: Fully tempered float glass.
 - 4. Interspace Content: Argon.
 - 5. Indoor Lite: Fully tempered float glass.
 - 6. Low-E Coating: Sputtered on second surface.
 - 7. Winter Nighttime U-Factor: 0.29 maximum.
 - 8. Summer Daytime U-Factor: 0.28 maximum.
 - 9. Visible Light Transmittance: 73 percent minimum.
 - 10. SHGC: 0.62 maximum.
 - 11. Safety glazing required.
- B. Ceramic-Coated, Low-E, Insulating Spandrel Glass Type GL-4T:
 - 1. Coating Color: As selected by Design Professional from manufacturer's full range.

2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Clear fully tempered float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Clear fully tempered float glass.
7. Low-E Coating: Sputtered on second surface.
8. Opaque Coating Location: Fourth surface.
9. Winter Nighttime U-Factor: 0.29 maximum.
10. Summer Daytime U-Factor: 0.28 maximum.

END OF SECTION 088000

SECTION 090190.52

MAINTENANCE REPAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes maintenance repainting as follows:
 - 1. Patching substrates.
 - 2. Repainting.
- B. Related Requirements:
 - 1. Section 013516 "Alteration Project Procedures" for general remodeling, renovation, repair, and maintenance requirements.
 - 2. Section 099113 "Exterior Painting," Section 099123 "Interior Painting," Section 099300 "Staining and Transparent Finishing," and Section 099600 "High-Performance Coatings" for paint materials and systems for new construction and top coat.

1.2 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 SEQUENCING AND SCHEDULING

- A. Perform maintenance repainting in the following sequence, which includes work specified in this and other Sections:
 - 1. Dismantle existing surface-mounted objects and hardware except items indicated to remain in place. Tag items with location identification and protect.
 - 2. Verify that temporary protections have been installed.
 - 3. Examine condition of surfaces to be painted.
 - 4. Remove existing paint to the degree required for each substrate and surface condition of existing paint.
 - 5. Apply paint system.
 - 6. Reinstall dismantled surface-mounted objects and hardware unless otherwise indicated.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include recommendations for product application and use.
 - 2. Include test data substantiating that products comply with requirements.
- B. Product List: For each paint product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each MPI-product category specified in paint systems, with the proposed product highlighted.
 - 3. VOC content.

1.6 INFORMATIONAL SUBMITTALS

- A. Preconstruction Test Reports: For cleaning materials, paint coatings and systems.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing of cleaning materials, compatibility of paint coatings and systems for each type of painted surface.
 - 1. Use test areas as indicated and representative of proposed materials and existing construction.
 - 2. Propose changes to materials and methods to suit Project.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient

temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste daily.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with maintenance repainting only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.
- B. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer for surface preparation and during paint application and drying periods.

PART 2 - PRODUCTS

2.1 PREPARATORY CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F.
- C. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for every 5 gal. of solution required.
- D. Mildewcide: Commercial proprietary mildewcide or a job-mixed solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.
- E. Abrasives for Ferrous Metal Cleaning: Aluminum oxide paper, emery paper, fine steel wool, steel scrapers, and steel-wire brushes of various sizes.
- F. Rust Remover: Manufacturer's standard phosphoric acid-based gel formulation, also called "naval jelly," for removing corrosion from iron and steel.

2.2 PAINT, GENERAL

- A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. Colors: Match surrounding surface, unless indicated on the drawings.

2.3 PATCHING MATERIALS

- A. Metal-Patching Compound: Two-part, polyester-resin, metal-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of metal repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be produced for filling metal that has deteriorated from corrosion. Filler shall be capable of filling deep holes and spreading to feather edge.
- B. Cementitious Patching Compounds: Cementitious patching compounds and repair materials specifically manufactured for filling cementitious substrates and for sanding or tooling prior to repainting; formulation as recommended in writing by manufacturer for type of cementitious substrate indicated, exposure to weather and traffic, the detail of work, and site conditions.
- C. Gypsum-Plaster Patching Compound: Finish coat plaster and bonding compound according to ASTM C842 and manufacturer's written instructions.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
1. Cover adjacent surfaces with materials that are proven to resist chemical solutions being used unless the solutions will not damage adjacent surfaces. Use protective materials that are UV resistant and waterproof. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 2. Do not apply chemical solutions during winds of sufficient force to spread them to unprotected surfaces.
 3. Neutralize and collect alkaline and acid wastes before disposal.
 4. Dispose of runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

3.2 MAINTENANCE REPAINTING, GENERAL

- A. Maintenance Repainting Appearance Standard: Completed work is to have a uniform appearance as viewed by Design Professional from building interior at 5 feet away from painted surface and from building exterior at 20 feet away from painted surface.
- B. Execution of the Work: In repainting surfaces, disturb them as minimally as possible and as follows:
 - 1. Remove failed coatings and corrosion and repaint.
 - 2. Verify that substrate surface conditions are suitable for repainting.
 - 3. Allow other trades to repair items in place before repainting.
- C. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use gentle methods, such as scraping and lightly hand sanding, that will not abrade softer substrates, reducing clarity of detail.
- D. Heat Processes: Do not use torches, heat guns, or heat plates.

3.3 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of painting work. Comply with paint manufacturer's written instructions for inspection.
- B. Maximum Moisture Content of Substrates: Do not begin application of coatings unless moisture content of exposed surface is below the maximum value recommended in writing by paint manufacturer and not greater than the following maximum values when measured with an electronic moisture meter appropriate to the substrate material:
 - 1. Concrete: 12 percent.
 - 2. Gypsum Board: 12 percent.
 - 3. Masonry (Clay and CMU): 12 percent.
- C. Alkalinity: Do not begin application of coatings unless surface alkalinity is within range recommended in writing by paint manufacturer. Conduct alkali testing with litmus paper on exposed plaster, cementitious, and masonry surfaces.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
 - 1. If existing surfaces cannot be prepared to an acceptable condition for proper finishing by using specified surface-preparation methods, notify Design Professional in writing.
- E. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.4 PREPARATORY CLEANING

- A. General: Use the gentlest, appropriate method necessary to clean surfaces in preparation for painting. Clean all surfaces, corners, contours, and interstices.
- B. Detergent Cleaning: Wash surfaces by hand using clean rags, sponges, and bristle brushes. Scrub surface with detergent solution and bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet. Rinse with water applied by clean rags or sponges.
- C. Solvent Cleaning: Use solvent cleaning to remove oil, grease, smoke, tar, and asphalt from painted or unpainted surfaces before other preparation work. Wipe surfaces with solvent using clean rags and sponges. If necessary, spot-solvent cleaning may be employed just prior to commencement of paint application, provided enough time is allowed for complete evaporation. Use clean solvent and clean rags for the final wash to ensure that all foreign materials have been removed. Do not use solvents, including primer thinner and turpentine, that leave residue.
- D. Mildew: Clean off existing mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. Rinse with water applied by clean rags or sponges.
- E. Chemical Rust Removal:
 - 1. Remove loose rust scale with specified abrasives for ferrous-metal cleaning.
 - 2. Apply rust remover with brushes or as recommended in writing by manufacturer.
 - 3. Allow rust remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing. Do not allow extended dwell time.
 - 4. Wipe off residue with mineral spirits and either steel wool or soft rags, or clean with method recommended in writing by manufacturer to remove residue.
 - 5. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
 - 6. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.
- F. Mechanical Rust Removal:
 - 1. Remove rust with specified abrasives for ferrous-metal cleaning. Clean to bright metal.
 - 2. Wipe off residue with mineral spirits and either steel wool or soft rags.
 - 3. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
 - 4. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.

3.5 SUBSTRATE REPAIR

- A. General: Repair substrate surface defects that are inconsistent with the surface appearance of adjacent materials and finishes.
- B. Cementitious Material Substrate:
 - 1. General: Repair defects including dents and chips more than 1/4 inch in size and all holes

- and cracks by filling with cementitious patching compound and sanding smooth. Remove protruding fasteners.
- 2. New and Bare Plaster: Neutralize surface of plaster with mild acid solution as recommended in writing by paint manufacturer. In lieu of acid neutralization, follow manufacturer's written instruction for primer or transition coat over alkaline plaster surfaces.
- 3. Concrete, Cement Plaster, and Other Cementitious Products: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. If surfaces are too alkaline to paint, correct this condition before painting.

C. Gypsum-Plaster and Gypsum-Board Substrates:

- 1. Repair defects including dents and chips more than 1/8 inch in size and all holes and cracks by filling with gypsum-plaster patching compound and sanding smooth. Remove protruding fasteners.
- 2. Rout out surface cracks to remove loose, unsound material; fill with patching compound and sand smooth.

3.6 PAINT APPLICATION, GENERAL

- A. Comply with manufacturers' written instructions for application methods unless otherwise indicated in this Section.
- B. Prepare surfaces to be painted according to the Surface-Preparation Schedule and with manufacturer's written instructions for each substrate condition.
- C. Apply a transition coat over incompatible existing coatings.
- D. Metal Substrate: Stripe paint corners, crevices, bolts, welds, and sharp edges before applying full coat. Apply two coats to surfaces that are inaccessible after completion of the Work. Tint stripe coat different than the main coating and apply with brush.
- E. Blending Painted Surfaces: When painting new substrates patched into existing surfaces or touching up missing or damaged finishes, apply coating system specified for the specific substrate. Apply final finish coat over entire surface from edge to edge and corner to corner.

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage paint-remover manufacturer's factory-authorized service representative for consultation and Project-site inspection and to provide on-site assistance when requested by Design Professional.
- B. Paint Material Testing: Engineer may engage the services of a qualified testing and inspecting agency to inspect and test paint for composition and dry film thickness.
 - 1. Paint Composition: The following procedure may be performed at any time and as often as Engineer deems necessary during the period when paints are being applied:

- a. Testing agency will sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
- b. Testing agency will perform tests for compliance of paint materials with product requirements.
- c. If test results show materials being used do not comply with product requirements, Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

2. Dry Film Thickness:

- a. Contractor shall touch up and restore painted surfaces damaged by testing.
- b. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.8 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Design Professional, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.9 SURFACE-PREPARATION SCHEDULE

- A. General: Before painting, prepare surfaces where indicated on Drawings for painting according to applicable requirements specified in this schedule.
 1. Examine surfaces to evaluate each surface condition according to paragraphs below.
 2. Where existing degree of soiling prevents examination, preclean surface and allow it to dry before making an evaluation.
 3. Repair substrate defects according to "Substrate Repair" Article.
- B. Surface Preparation for MPI DSD 0 Degree of Surface Degradation:
 1. Surface Condition: Existing paint film in good condition and tightly adhered.
 2. Paint Removal: Not required.

3. Preparation for Painting: Wash surface by detergent cleaning; use solvent cleaning where needed. Roughen or degloss cleaned surfaces to ensure paint adhesion according to paint manufacturer's written instructions.

C. Surface Preparation for MPI DSD 1 Degree of Surface Degradation:

1. Surface Condition: Paint film cracked or broken but adhered.
2. Paint Removal: Scrape by hand-tool cleaning methods to remove loose paint until only tightly adhered paint remains.
3. Preparation for Painting: Wash surface by detergent cleaning; use other cleaning methods for small areas of bare substrate if required. Roughen, degloss, and sand the cleaned surfaces to ensure paint adhesion and a smooth finish according to paint manufacturer's written instructions.

3.10 INTERIOR MAINTENANCE REPAINTING SCHEDULE

A. Interior Walls

1. Latex System over Waterborne Primer: MPI RIN 9.2A system over a transition coat if required.
 - a. Prime Coat:
 - 1) For MPI DSD 0&1 degree of surface degradation, touch up with topcoat.
 - b. Intermediate Coat: Latex matching topcoat
 - c. Topcoat: Refer to 09 91 24 "Interior Painting (MPI Standards)" for each type of wall.

END OF SECTION 090190.52

SECTION 092216

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstructural steel framing.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of nonstructural steel framing and fastening and anchorage details.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, and attachments to adjoining work.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For code-compliance certification of studs and track.

- B. Evaluation Reports: From an agency acceptable to authorities having jurisdiction showing compliance with Project requirements, for the following:

1. Studs and track.
2. High-strength steel studs and track.
3. Equivalent corrosion-resistant coating on steel framing.
4. Firestop track.
5. Post-installed anchors.

1.5 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Track: Provide documentation that framing

members are certified in accordance with product-certification program of the Steel Framing Industry Association the Steel Stud Manufacturers Association or the Supreme Steel Framing System Association.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Protect materials from corrosion, deformation, and other damage during delivery, storage, and handling in accordance with AISI S202.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Where indicated on Drawings, provide assemblies incorporating nonstructural steel framing identical to those of assemblies tested for fire resistance in accordance with ASTM E119 by an independent testing agency.
- B. Horizontal Deflection: For composite wall assemblies, limited to 1/240 of the wall height based on the following horizontal loading:
 - 1. Horizontal Loading: 5 lbf/sq. ft.

2.2 NONSTRUCTURAL STEEL FRAMING

- A. Framing Members, General: Comply with requirements in AISI S220 for conditions indicated on Drawings.
 - 1. Protective Coating: ASTM A653/A653M, G40 and ASTM A653/A653M, G60 at walls indicated to have tile or coating with demonstrated equivalent corrosion resistance. Galvannealed products are unacceptable.
 - a. Equivalent Corrosion-Resistant Coating: Evaluation report acceptable to authorities having jurisdiction demonstrates corrosion resistance equivalent to specified protective coating.
- B. Studs and Track: Conventional members, roll-formed into standard shapes without surface deformations to stiffen framing members.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich
 - b. Jaimes Industries, Inc.

- c. Marino\WARE
 - d. Steel Construction Systems; Stone Group of Companies
 - e. Steel Network, Inc. (The)
 - 2. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection but not less than 0.0296 inch.
 - 3. Minimum Yield Strength: 33 ksi.
 - 4. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated on Drawings, provide one of the following:
- 1. Slotted Deflection Track: Steel sheet top track manufactured with 2-1/2-inch- deep flanges that allow positive attachment to studs through long slots and prevent deflection of structure above from cracking finishes applied to framing; in base-steel thickness not less than that of studs and in width to accommodate depth of studs.
 - 2. Double-Track System: Top outer track sized to friction-fit over inner track and inner track with 2-inch- deep flanges in base-steel thickness not less than that of studs and fastened to studs.
- D. Rigid Hat-Shaped Furring Channels:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich
 - b. Jaimes Industries, Inc.
 - c. Marino\WARE
 - d. Steel Construction Systems; Stone Group of Companies
 - e. Steel Network, Inc. (The)
 - 2. Minimum Base-Steel Thickness: 0.0296 inch.
 - 3. Depth: As indicated on Drawings.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
- 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Adjustable Wall-Furring Brackets: ASTM A653/A653M G40 hot-dip galvanized steel sheet in minimum 0.0329-inch- base-steel thickness with serrated edges for attaching furring channels to exterior masonry or concrete walls.
- C. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
- 1. Adjustable Wall-Furring Brackets for Tie Wire: Use minimum double strand of 0.0625-inch- diameter wire, or triple strand of 0.0475-inch- diameter wire to attach furring channels.

- 2. Suspended-Ceiling Systems:
 - a. Splicing Carrying Channels and Furring Members: Use double loops of minimum 0.0625-inch- diameter wire.
 - b. Saddle Tying Main Runners and Cross Furring: Use minimum 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.
- D. Post-Installed Anchors: Fastener systems with an evaluation report, acceptable to authorities having jurisdiction, based on ICC-ES AC193 AC308 as appropriate for the substrate.
 - 1. Securing Hangers:
 - a. Type: torque-controlled, adhesive anchor or adhesive anchor.
 - b. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated on Drawings.
- E. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.162 inch in diameter.
- F. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, substrates, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices required to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling track to surfaces indicated on Drawings to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of nonstructural steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated on Drawings. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION OF NONSTRUCTURAL METAL FRAMING, GENERAL

- A. Installation Standard: ASTM C754.
 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with framing members. Frame both sides of joints independently.

3.4 INSTALLATION OF NONSTRUCTURAL STEEL FRAMING

- A. Install framing system components at spacings indicated on Drawings, but not greater than spacings required by referenced installation standards for assembly types.
 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated on Drawings.
 2. Multilayer Application: 16 inches o.c. unless otherwise indicated on Drawings.
 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated on Drawings.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install track at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated on Drawings to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished

- assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated on Drawings.
 - b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure unless otherwise indicated on Drawings.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated on Drawings. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated on Drawings and support closures to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Install to maintain continuity of fire-resistance-rated assembly indicated on Drawings.
- E. Direct Furring:
1. Screw to wood framing.
 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Wall-Furring Bracket Systems: Install brackets with serrated edges facing upward spaced at minimum 48 inches o.c. vertically with 6 inches maximum from floor and ceiling, and minimum 36 inches o.c. horizontally with 4 inches maximum from abutting construction, unless otherwise indicated on Drawings.
- G. Installation Tolerances for Nonstructural Steel Framing:
1. Framing Members: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for nonstructural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Locations and installation of control and expansion joints, including plans, elevations, sections, and attachment details.

1.3 MOCKUPS

- A. Notify Design Professional and Engineer when gypsum board is completely hung and finish compound is sanded smooth. Design Professional and Engineer shall review gypsum wall board installation before priming and painting. Proceed with coating application only after unsatisfactory conditions have been corrected. This review does not constitute approval of deviations from the Contract Documents unless Design Professional's specifically approves such deviations in writing.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings in accordance with ASTM E119; tested by a qualified testing agency.

2.3 GYPSUM BOARD, GENERAL

- A. Size: Provide panel products in maximum lengths and widths available that will minimize joints in each area and that correspond with support system specified or indicated on Drawings.

2.4 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C1396/C1396M.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum
 - b. CertainTeed; SAINT-GOBAIN
 - c. Georgia-Pacific Gypsum LLC
 - d. Gold Bond Building Products, LLC provided by National Gypsum Company
 - e. USG Corporation

2. Thickness: As indicated on Drawings.
3. Long Edges: Tapered.

2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. James Hardie Building Products, Inc.
 - b. PermaBASE Building Products, LLC provided by National Gypsum Company
 - c. USG Corporation
 2. Thickness: As indicated on Drawings.
 3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
 1. Material: Galvanized-steel sheet or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M requirements.
 1. Mold-Resistant Joint Compound: Use mold-resistant formulations with mold-resistant panel products.
- B. Joint Tape:
 1. Interior Gypsum Board: Paper.
 2. Tile Backing Panels: As recommended in writing by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended in writing by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended in writing by manufacturer for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C1002 unless otherwise specified or indicated on Drawings.
 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended in writing by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers as follows:
 1. Non-Fire-Resistance-Rated Assemblies: slag or rock wool.
 2. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840 requirements.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Install sound-attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Gypsum Board, Type X: As indicated on Drawings.
- B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated on Drawings.
 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise specified or indicated on Drawings or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 INSTALLATION OF TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 APPLICATION OF JOINT TREATMENT MATERIALS

- A. Finishing Panel Products: Treat joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare panel surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over panel joints, except for trim products specifically indicated as not intended to receive tape.
- D. Interior Gypsum Board: Finish panels to levels indicated below and in accordance with ASTM C840:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Panels that are substrate for tile.
 3. Level 3: Where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

- a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- 5. Level 5: Where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- E. Cementitious Backer Units: Finish in accordance with manufacturer's written instructions.

3.6 PROTECTION

- A. Protect adjacent surfaces from joint compound and promptly remove from floors and other non-gypsum board surfaces. Repair surfaces stained, marred, or otherwise damaged during gypsum board installation and finishing.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013

CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Porcelain tile.
2. Glazed wall tile.
3. Polished Marble tile.
4. Thresholds.
5. Crack isolation membranes.
6. Setting material.
7. Grout materials.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of movement joints in tile surfaces.
2. Section 092900 "Gypsum Board" for tile backing panels.

1.2 DEFINITIONS

- A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. Face Size: Actual tile size, excluding spacer lugs.
- C. Large Format Tile: Tile with at least one edge 15 inches or longer.
- D. Module Size: Actual tile size plus joint width indicated.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: Show locations, plans, and elevations, of each type of tile and tile pattern. Show widths, details, and locations of movement joints in tile substrates and finished tile surfaces. Show thresholds.
- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection or shade variation.
- D. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Full-size units of each type of trim and accessory for each color and finish required.
 - 3. Metal flooring transitions 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product, including product use classification.
- D. Product Test Reports:
 - 1. Tile-setting and -grouting products.
 - 2. Certified porcelain tile.
 - 3. Slip-resistance test reports from qualified independent testing agency.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials, from the same production run, to Engineer that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's supervisor for Project holds the International Masonry Institute's Supervisor Certification.
 - 2. Installer employs only Ceramic Tile Education Foundation Certified Installers for Project.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup of tile installation as indicated on the drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.11 WARRANTY

- A. System Warranty: Manufacturer's non-prorated comprehensive warranty that agrees to repair and replace defective installation areas, material, and labor that fail under normal usage within specified warranty period.
 - 1. Warranty Period: Five years from date of Product Purchase.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard Grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI

A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
- E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 CERAMIC MOSAIC TILE

- A. Ceramic Mosaic Tile Type (CT-6): Glazed matte.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Olean; a brand of Dal-Tile Corporation
 - b. Crossville, Inc.
 - c. Daltile; a brand of Dal-Tile Corporation (Basis of Design Color Wheel Mosaics)
 - d. Interceramic
 - e. Vitromex USA, Inc.
 - 2. Certification: Porcelain tile certified by the Porcelain Tile Certification Agency.
 - 3. Module Size: 2 by 2 inches.
 - 4. Thickness: 1/4 inch.
 - 5. Face: Plain with cushion edges.
 - 6. Surface: Smooth, without.
 - 7. Wet & Level: DCOF wet greater than or equal to 0.42.
 - 8. Product Use Classification: Interior, Wet Plus (IW+)
 - 9. Tile Color and Pattern: As selected by Architect from manufacturer's full range or as indicated on the drawings.
 - 10. Grout Color: As selected by Architect from manufacturer's full range.
 - 11. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

2.3 PORCELAIN TILE

A. Porcelain Tile Type (CT-5): Glazed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Rockwood or comparable product by one of the following:
 - a. Daltile; a brand of Dal-Tile Corporation
 - b. WS Tiles
 - c. Fireclay tile
 - d. Edward Martin
2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 3 by 6 inches.
4. Face Size Variation: Rectified.
5. Thickness: 1/4 inch.
6. Product Use Classification: Interior, Wet (IW).
7. Physical Properties: Chemical resistant when tested with indicated chemicals in accordance with ASTM C650.
8. Tile Color, Glaze, and Pattern: As indicated on the drawings.
9. Grout Color: As selected by Architect from manufacturer's full range.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base Cap: Surface bullnose, module size same as adjoining flat tile.
 - b. Wainscot Cap: Surface bullnose, module size same as adjoining flat tile.
 - c. External Corners: Surface bullnose, module size same as adjoining flat tile.
 - d. Internal Corners: Field-buttet square corners.
 - e. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

B. Porcelain Tile Type (CT-8): Glazed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Daltile, Wanderwise or comparable product by one of the following:
 - a. American Olean; a brand of Dal-Tile Corporation.
 - b. Crossville, Inc.
 - c. Florida Tile.
2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 12 x 24 inches.
4. Face Size Variation: Rectified.
5. Thickness: 5/16 inch.
6. Product Use Classification: Interior, Wet (IW).
7. Tile Color, Glaze, and Pattern: As indicated on the drawings.
8. Grout Color: As selected by Architect from manufacturer's full range.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where

applicable and matching characteristics of adjoining flat tile.

C. Porcelain Tile Type (CT-3): Glazed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide tilebar, Morocco (Picket) or comparable product by one of the following:
 - a. Crossville, Inc.
 - b. Daltile; a brand of Dal-Tile Corporation
2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 4x8 inches picket.
4. Face Size Variation: Rectified.
5. Thickness: 5/16 inch.
6. Product Use Classification: Interior, Wet (IW).
7. Tile Color, Glaze, and Pattern: As indicated on the drawings.
8. Grout Color: As selected by Architect from manufacturer's full range.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile.

2.4 GLAZED WALL TILE

A. Glazed Wall Tile Type (CT-2):

1. Basis-of-Design Product: Subject to compliance with requirements, provide STP Tile Flauti, or comparable product by one of the following:
 - a. American Olean; a brand of Dal-Tile Corporation
 - b. Crossville, Inc.
 - c. Daltile; a brand of Dal-Tile Corporation
 - d. Marazzi USA; a brand of Dal-Tile Corporation
2. Module Size: 12 x 16 inch standard sheet.
3. Face Size Variation: Rectified.
4. Thickness: 5/16 inch.
5. Tile Color and Pattern: As indicated on the drawings.
6. Grout Color: As selected by Architect from manufacturer's full range.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile.

B. Glazed Wall Tile Type (CT-7):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Daltile, Colorwheel, or comparable product by one of the following:
 - a. American Olean; a brand of Dal-Tile Corporation
 - b. Crossville, Inc.
 - c. Marazzi USA; a brand of Dal-Tile Corporation

2. Module Size: 3 x 6 inch.
3. Face Size Variation: Rectified.
4. Thickness: 5/16 inch.
5. Tile Color and Pattern: As indicated on the drawings.
6. Grout Color: As selected by Architect from manufacturer's full range.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile.

C. Glazed Wall Tile Type (CT-9):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Daltile, Colorwheel, or comparable product by one of the following:
 - a. American Olean; a brand of Dal-Tile Corporation
 - b. Crossville, Inc.
 - c. Marazzi USA; a brand of Dal-Tile Corporation
2. Module Size: 6 x 6 inch.
3. Face Size Variation: Rectified.
4. Thickness: 5/16 inch.
5. Tile Color and Pattern: As indicated on the drawings.
6. Grout Color: As selected by Architect from manufacturer's full range.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile.

2.5 POLISHED MARBLE-PERAL AND BARSS MOSAIC TILE

A. Mosaic Wall Tile Type (CT-4):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tile Bar, Adaya, or comparable product.
2. Module Size: 12 x 12 inch.
3. Thickness: 0.374 inch.
4. Tile Color and Pattern: As indicated on the drawings.
5. Grout Color: As selected by Architect from manufacturer's full range.
6. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile.

2.6 WATERPROOF MEMBRANES

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and ANSI A118.12 and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.

2.7 CRACK ISOLATION MEMBRANES

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard performance and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Crack Isolation Membrane, Polyethylene Sheet: Polyethylene faced on both sides with polyester fabric.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Laticrete International, Inc.
 - b. MAPEI Corporation
 - c. Noble Company (The)
 - d. Schluter Systems L.P.

2.8 SETTING MATERIALS

- A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ARDEX Americas
 - b. Bostik; Arkema
 - c. C-Cure
 - d. Laticrete International, Inc.
 - e. MAPEI Corporation
 - f. Parex, a Sika brand
 - g. Schluter Systems L.P.
 - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 3. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.
 - 4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.4.

2.9 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Standard Cement Grout: ANSI A118.6.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ARDEX Americas
- b. Bostik; Arkema
- c. C-Cure
- d. Laticrete International, Inc.
- e. MAPEI Corporation
- f. Parex, a Sika brand
- g. Sika Corporation

2.10 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting and adhesive materials for installations indicated.
- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils thick.
- C. Metal Flooring Transitions: Profile designed specifically for flooring applications; height to match tile and setting-bed thickness.
 - 1. Description: L-shaped.
 - 2. Material and Finish: Metallic or combination of metal and PVC or neoprene base; polished chrome anodized aluminum exposed-edge material.
- D. Temporary Protective Coating: Formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products and easily removable after grouting is completed without damaging grout or tile.
- E. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- F. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with

surface finish requirements in ANSI A108.01 for installations indicated.

- a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.
- B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot toward drains.
- D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- E. Substrate Flatness:
 1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.
 2. For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.
- F. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION OF CERAMIC TILE SYSTEM

- A. Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

- B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
 - 1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.
- C. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
 - 1. Allow crack isolation membrane to cure before installing tile or setting materials over it.
- D. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
 - 1. Add materials, water, and additives in accurate proportions.
 - 2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.
- E. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Exterior tile floors and walls.
 - b. Tile floors in wet areas.
 - c. Tile swimming pool decks.
 - d. Tile floors in laundries.
 - e. Tile floors consisting of tiles 8 by 8 inches or larger.
 - f. Tile floors consisting of rib-backed tiles.
 - 2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
 - 3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
 - 4. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
 - 5. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
 - 6. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

- a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets, so joints between sheets are not apparent in finished Work.
 - b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
7. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- F. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.
 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- G. Thresholds: Install stone and solid surface thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in modified dry-set mortar (thinset).
 2. Do not extend waterproof membrane or crack isolation membrane under thresholds set in modified dry-set or improved modified dry-set mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane with elastomeric sealant.
- H. Metal Flooring Transitions: Install at locations indicated.
- I. Metal Wall Trim: Install at locations indicated on Drawings.
- J. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 FIELD QUALITY CONTROL

- A. Water Test:
 1. Test of waterproofing membrane in showers and similar areas to be performed by Installation Contractor before setting tile.
 - a. Perform test after 24 hours of waterproof membrane installation.
 - b. Insert test plug in drain or waste line.
 - c. Fill shower base with water, high enough that the membrane-to-drain connection and floor-to-wall transition can be evaluated, and mark wall.
 - d. Check for leaks after 24 hours.
 2. Test to be witnessed by Architect.

B. Nonconforming Work:

1. Waterproof membrane will be considered defective if water level has dropped.
2. Remove and replace defective components and retest.

3.5 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
1. Remove grout residue from tile as soon as possible.
 2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. TCNA F125-Full: Thinset mortar on crack isolation membrane.
 - a. Ceramic Tile Type: CT-6, and CT-8
 - b. Thinset Mortar: Modified dry-set mortar.
 - c. Grout: Standard unsanded cement grout.
 - d. Crack Isolation Membrane: As recommended by setting material manufacturer.
 - e. Joint Width: 3/16 inch.
 - f. Movement Joints: Types located on Drawings.

B. Interior Wall Installations, Wood or Metal Studs or Furring:

1. TCNA W245: Thinset mortar on glass-mat, water-resistant cement backer board.
 - a. CT-2, CT-3, CT-4, & CT-9
 - b. Thinset Mortar: Modified dry-set mortar.
 - c. Grout: Standard sanded cement grout.
 - d. Joint Width: 3/16 inch.
 - e. Movement Joints: Types located on Drawings.
- C. Bathtub/Shower Wall Installations:
 1. TCNA B419 : Thinset mortar over waterproof membrane on coated glass-mat, water-resistant cement backer board.
 - a. Ceramic Tile Type: CT-5 and CT-7.
 - b. Thinset Mortar: Modified dry-set mortar.
 - c. Grout: Standard unsanded cement grout.
 - d. Waterproof Membrane: As recommended by setting material manufacturer.
 - e. Joint Width: 3/16 inch.
 - f. Movement Joints: Types located on Drawings.

END OF SECTION 093013

SECTION 095113

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Acoustical panels.
 - 2. Metal suspension system.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Ceiling suspension-system members.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Method of attaching hangers to building structure.
 - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 - 5. Size and location of initial access modules for acoustical panels.
 - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles.
 - d. Speakers.
 - e. Sprinklers.
 - f. Access panels.

7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
8. Minimum Drawing Scale: 1/4 inch = 1 foot.

- B. Qualification Data: For testing agency.
- C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type] from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations for Ceiling System: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A in accordance with ASTM E1264.
 - 2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS

- A. Acoustical Panels:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Calla or comparable product by one of the following:
 - a. CertainTeed; SAINT-GOBAIN
 - b. USG Corporation
 - 2. Acoustical Panel Standard: Provide manufacturer's standard panels in accordance with ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
 - 3. Classification: Provide panels as follows:
 - a. Type and Form: Type A, Form A2.2: Wet-formed mineral fiber with acoustically transparent membrane.
 - b. Pattern: G (smooth).
 - 4. Color: As indicated on Drawings.
 - 5. Light Reflectance (LR): Not less than 0.85 at white color tile only.
 - 6. Ceiling Attenuation Class (CAC): Not less than 35.
 - 7. Noise Reduction Coefficient (NRC): Not less than 0.85.
 - 8. Articulation Class (AC): Not less than 170.
 - 9. Edge/Joint Detail: Square.
 - 10. Thickness: 1 inch.
 - 11. Modular Size: As indicated on Drawings.
 - 12. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested in accordance with ASTM D3273, ASTM D3274, or ASTM G21 and evaluated in accordance with ASTM D3274 or ASTM G21.

2.4 METAL SUSPENSION SYSTEM

A. Exposed Metal Suspension System:

1. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories in accordance with ASTM C635/C635M and designated by type, structural classification, and finish indicated.
2. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
 - a. Structural Classification: Heavy-duty system.
 - b. End Condition of Cross Runners: butt-edge type.
 - c. Face Design: Flat, flush.
 - d. Cap Material: Cold-rolled steel.
 - e. Cap Finish: Painted to match color of acoustical unit.

2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF ACOUSTICAL PANEL CEILINGS

- A. Install acoustical panel ceilings in accordance with ASTM C636/C636M and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 7. Do not attach hangers to steel deck tabs.
 - 8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 - 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of

- 2. moldings before they are installed.
- 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
- 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
 - 1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 - 3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 09651

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoset rubber base.
2. Vinyl molding accessories.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for removing existing floor coverings.
2. Section 096516 "Resilient Sheet Flooring" for resilient rolled flooring.
3. Section 096519 "Resilient Tile and Plank Flooring" for modular resilient flooring.
4. Section 096813 "Tile Carpeting" for modular carpet tile flooring.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to resilient base and accessory installation including, but not limited to, the following:
 - a. Delivery, storage, and handling procedures.
 - b. Ambient conditions and ventilation procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation instructions for each type of substrate.

B. Samples for Initial Selection: For each type of exposed product.

C. Samples for Verification: For each type of exposed product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

D. Product Schedule: For resilient base and accessory products. Use same designations indicated

on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For resilient base and accessory products, for tests performed by a qualified testing agency.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials, from the same production run, to Engineer that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear ft. for every 500 linear ft. or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: As determined by testing identical products in accordance with ASTM E648 or ASTM E662 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 RESILIENT BASE

A. Thermoset Rubber Base:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mannington Mills, Inc
 - b. Roppe Corporation; Roppe Holding Company
 - c. Tarkett USA
 - d. Armstrong
2. Classification: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
3. Style and Location:
 - a. Style A, Straight: Provide in areas with carpet.
 - b. Style B, Cove: Provide in areas with resilient floor coverings.
4. Thickness: 0.125 inch.
5. Height: 4 inches.
6. Lengths: Coils in manufacturer's standard length.
7. Outside Corners: Job formed.
8. Inside Corners: Job formed.
9. Colors: As indicated on the drawings..

2.3 RESILIENT MOLDING ACCESSORIES

A. Vinyl Molding Accessories :

1. Accessory Description: transition strips.
2. Profile and Dimensions: As indicated.

B. Locations: Provide resilient molding accessories in areas indicated and at flooring material transitions.

C. Colors and Patterns: As indicated by manufacturer's designations.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended in writing by resilient-product manufacturer for

resilient products and substrate conditions indicated.

- C. Metal Edge Strips: Extruded aluminum with mill finish, as indicated on the drawings, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates in accordance with manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 INSTALLATION OF RESILIENT BASE

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of

adjacent pieces aligned.

- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope corners to minimize open joints.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096516

RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Unbacked vinyl sheet flooring.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient sheet flooring.
 - 1. Include sheet flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 2. Show details of special patterns.
- C. Samples for Initial Selection: For each type of resilient sheet flooring indicated.
- D. Samples for Verification: For each type of resilient sheet flooring, in manufacturer's standard size, but not less than 6-by-9-inch sections of each color, texture, and pattern required.
 - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
- E. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch. Sample applied to a rigid backing and prepared by Installer for this Project.
- F. Product Schedule: For resilient sheet flooring.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Resilient Sheet Flooring: Furnish not less than 10 linear feet> for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during resilient sheet flooring installation.
- D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

- E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 UNBACKED VINYL SHEET FLOORING (RSF-X)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong Flooring, Inc., Medintone & Medintech
 - 2. Gerflor USA, Mipolam Symbioz
 - 3. Tarkett, iQ Optima (Basis of Design)
 - 4. Polyflor, Paletone PUR.
- B. Product Standard: ASTM F1913.
- C. Thickness: 0.080 inch.
- D. Wearing Surface: Smooth.
- E. Sheet Width: 6 feet.
- F. Seamless-Installation Method: Heat welded.
- G. Colors and Patterns: Refer to the drawings.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.
- C. Seamless-Installation Accessories:
 - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

- a. Colors: Match flooring.
- D. Integral-Flash-Cove-Base Accessories:
 - 1. Cove Strip: 1-inch radius provided or approved by resilient sheet flooring manufacturer.
 - 2. Cap Strip: Square metal, vinyl, or rubber cap or approved by resilient sheet flooring manufacturer.
- E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.
- B. Concrete Substrates: Prepare according to ASTM F710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

- b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient sheet flooring until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient sheet flooring.
- B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.
- C. Lay out resilient sheet flooring as follows:
 - 1. Maintain uniformity of flooring direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
 - 3. Match edges of flooring for color shading at seams.
 - 4. Avoid cross seams.
- D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- H. Seamless Installation:
 - 1. Heat-Welded Seams: Comply with ASTM F1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare

seam for weld with robot machine, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

- I. Integral-Flash-Cove Base: Cove resilient sheet flooring to dimension indicated up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.
- B. Perform the following operations immediately after completing resilient sheet flooring installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.
 - 1. Apply three coats.
- E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 096516

SECTION 096519
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Solid vinyl floor tile.
- 2. Rubber floor tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient floor tile.
 - 1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 2. Show details of special patterns.
- C. Samples for Initial Selection: For each type of floor tile indicated.
- D. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 SOLID VINYL FLOOR TILE (LVT-X)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Biltrite.
 - 2. Armstrong Flooring, Inc.,
 - 3. Tarkett, iQ Optima (Basis of Design).
 - 4. Gerflor USA.
- B. Tile Standard: ASTM F1700.
 - 1. Class: Class I, Monolithic Vinyl Tile.
 - 2. Type: A, Smooth Surface.
- C. Thickness: 0.080 inch.
- D. Size: As indicated on the drawings.
- E. Colors and Patterns: As indicated in the drawings.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles in pattern of colors and sizes indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply two coats.
- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096813

TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Carpet tile.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for removing existing floor coverings.
2. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.

6. Pattern type, location, and direction.
 7. Pile direction.
 8. Type, color, and location of insets and borders.
 9. Type, color, and location of edge, transition, and other accessory strips.
 10. Transition details to other flooring materials.
- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of carpet tile.
1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.
- D. Samples for Verification: Actual sample of finished products for each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Carpet Tile: Full-size Sample.
 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.
- E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- B. Qualification Statements: For Installer.
- C. Sample Warranties: For carpet tile.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles. Include the following:
 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials, from the same production run, to Engineer that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 10 full-size units.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended in writing by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, the following:
 - a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
 - b. Loss of tuft-bind strength.
 - c. Excess static discharge.
 - d. Delamination.
 - e. Dimensional instability.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Hero, Drizzle or comparable product by one of the following:
 - 1. J&J Flooring Group LLC
 - 2. Mannington Commercial; a business unit of Mannington Mills, Inc.
- B. Color: As indicated on the drawings.
- C. Pattern: As indicated on the drawings.
- D. Fiber Content: 100 percent nylon 6.
- E. Pile Characteristic: Level-loop pile.
- F. Stitches: 11 stitches per inch.
- G. Gage: 1 per inch.
- H. Surface Pile Weight: 15 oz./sq. yd.
- I. Primary Backing/Backcoating: Manufacturer's standard composite materials.
- J. Size: As indicated on the drawings.
- K. Applied Treatments:
 - 1. Soil-Resistance Treatment: Manufacturer's standard treatment.
 - 2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:
 - a. Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria, not less than 1 mm halo of inhibition for gram-negative bacteria, and no fungal growth, in accordance with AATCC 174.
- L. Performance Characteristics:
 - 1. Texture Appearance Retention Rating (TARR): Moderate traffic, 2.5 minimum in accordance with ASTM D7330.
 - 2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm in accordance with NFPA 253.
 - 3. Floor Covering: Floor covering to comply with the requirements of DOC FF-1 "Pill Test" (CPSC 16 CFR Part 1630) or with ASTM D2859.
 - 4. Dry Breaking Strength: Not less than 100 lbf in accordance with ASTM D2646.
 - 5. Tuft Bind: Not less than 10 lbf in accordance with ASTM D1335.
 - 6. Delamination: Not less than 3.5 lbf/in. in accordance with ASTM D3936.

7. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
8. Colorfastness to Crocking: Not less than 4, wet and dry, in accordance with AATCC 165.
9. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) in accordance with AATCC 16.3 Option 3.
10. Electrostatic Propensity: Less than 3.5 kV in accordance with AATCC 134.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended in writing by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive types to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and that are recommended in writing by carpet tile manufacturer for releasable installation.
- C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, in accordance with manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns indicated on Drawings.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended in writing by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended in writing by carpet tile manufacturer.
 2. Remove yarns that protrude from carpet tile surface.
 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 13.7.
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 097200

WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl wall covering.
2. Thermoplastic-polyolefin wall covering.
3. Wallpaper (Architectural Film).

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Samples for Initial Selection: For each type of wall covering.

C. Samples for Verification: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36 inches long in size.

1. Wall-Covering Sample: From same production run to be used for the Work, with specified treatments applied.
 - a. Show complete pattern repeat.
 - b. Mark top and face of fabric.

D. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each wall covering, for tests performed by a qualified testing agency.

B. Qualifications: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Wall-Covering Materials: For each type, color, texture, and finish, full width by length to equal to 5 percent of amount installed.

1.7 QUALIFICATIONS

- A. Manufacturer: Provide each type of digitally printed vinyl wallcovering mural required produced by one manufacturer whose published product literature clearly indicates compliance of wallcovering ground with specified requirements.
- B. Installer: Installation by skilled commercial wallcovering applicator with no less than three years of documented experience installing wallcovering murals of the types and extent specified for the project.

1.8 PROJECT DELIVERY, STORAGE, AND HANDLING

- A. Deliver digitally printed vinyl wallcovering material to the project site in unbroken and undamaged wrappings and clearly labeled with manufacturer's identification label, quality or grade, UL label and side mark..
- B. Store materials in a clean, dry storage area with temperature maintained above 55 degrees with normal humidity.
- C. Store material in a flat position to prevent damage to roll-ends. Do not cross stack material. Support material off the floor in a manner to prevent sagging and warping.

1.9 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for installation.
 - 1. Build mockups for each type of wall covering at locations indicated on the drawings. Comply with requirements in ASTM F1141 for appearance shading characteristics.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Design Professional specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.
 - 1. Wood-Veneer Wall Coverings: Condition spaces for not less than 48 hours before installation.
- B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.
- C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.
- D. Maintain constant recommended temperature and humidity for a least 72 hours prior to installation, throughout the installation period, and for 72 hours after wallcovering installation completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates in accordance with test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire-Growth Contribution: No flashover and heat and smoke release when tested in accordance with NFPA 286.
- B. Underwriters Laboratories Approval: Provide materials that have been tested and approved by Underwriters Laboratories.

2.2 VINYL WALL COVERING (WC-2)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Level, Basis of Design
 2. Korseal
- B. Description: Provide vinyl products in rolls from same production run and complying with the following:
1. FS CCC-W-408D and Wallcovering Association's W-101 for Type II, Medium Duty.
- C. Total Weight: 20 oz., excluding coatings.
- D. Backing: Osnaburg fabric.
- E. Mildew Resistance: Rating of zero or 1 when tested in accordance with ASTM G21.
- F. Features:
1. Antimicrobial.
 2. Water-based inks.
 3. Phthalate free.
 4. Heavy-metals free.
 5. Halogenated-fire-retardant free.
- G. Colors, Textures, and Patterns: As indicated on the drawings.
- 2.3 THERMOPLASTIC-POLYOLEFIN WALL COVERING (WC-3)
- A. Basis-of-Design Product: Subject to compliance with requirements, provide Carnegie Fabrics, LLC or comparable product by one of the following:
1. Knoll, Inc.
- B. Description: Provide products complying with Wallcoverings Association's W-101; free of PVC, chlorine, plasticizers, formaldehyde, heavy metals, and halogenated fire retardants; with water-based inks and coatings; with antimicrobial additives; and in rolls from same production run.
1. Type: Type II, Medium Duty.
- C. Total Weight: 20 oz per linear yard, excluding coatings.
- D. Width: 52 inches.
- E. Backing: Nonwoven fabric.
- F. Repeat: 11 inches length x 26 inches width.
- G. Features:
1. Microvented.

- H. Colors, Textures, and Patterns: As indicated on the drawings.

2.4 WALLPAPER (Architectural Film WC-4 & WC-5)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Korseal, Reatec or comparable product by one of the following:
 - 1. 3M
- B. Description: Architectural Film Interior Surfacing.
 - 1. Description:
 - a. Architectural overlay with pressure sensitive adhesive backing.
 - b. Precision manufactured from blend of synthetic, engineered plastics, produced using calendaring process, and printed using high-definition presses.
 - c. Thickness: Maximum 6 mils without adhesive layer, 8.5 mils with adhesive layer.
 - 2. Fire Hazard Classification: Class A, tested to ASTM E84 and UL 723.
- C. Colors, Textures, and Patterns: As indicated on the drawings.

2.5 ACCESSORIES

- A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.
- B. Primer/Sealer: Mildew resistant, complying with requirements in Section 099123 "Interior Painting" and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.
- C. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended in writing by wall-covering manufacturer.
- D. Seam Tape: As recommended in writing by wall-covering manufacturer.
- E. Medium Density Fiberboard and Raw Wood Sealer: Acrylic, low-luster polyurethane type as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation surfaces being true in plane and vertical and horizontal alignment, maximum

moisture content, and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, and mildew.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
 - 1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
 - 2. Plaster: Allow plaster to cure for at least 90 days. Neutralize areas of high alkalinity. Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 - 3. Metals: If not factory primed, clean and apply metal primer as recommended in writing by metal-primer manufacturer and wall-covering manufacturer.
 - 4. Gypsum Board: Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 - 5. Painted Surfaces:
 - a. Check for pigment bleeding. Apply primer/sealer to areas susceptible to pigment bleeding as recommended in writing by primer/sealer manufacturer.
 - b. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.
- D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION OF WALL COVERING

- A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.
- B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.
- C. Install strips in same order as cut from roll.
 - 1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip.
- D. Install wall covering without lifted or curling edges and without visible shrinkage.

- E. Match pattern per manufacturer's recommendations above the finish floor.
- F. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.
- G. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 INSTALLATION OF ARCHITECTURAL FILM

- A. Examination.
 - 1. Ensure substrates are: non-porous and hard, free from gaps and overlaps, and smooth, free from wrinkles and bubbles.
- B. Preparation:
 - 1. Finish sand surfaces to achieve proper adhesive bond surface. Re-clean surfaces after any sanding is complete. Apply proper surface sealer, primer, or secondary adhesive as required by substrate complexity. Protect prepared surface from contamination until application.
 - 2. Comply with manufacturer's written instructions for surface preparation, coordinate substrate requirements with installer.
- C. Installation: Per manufacturer's written instructions and recommendations.
 - 1. Install architectural film surfacing using a manufacturer's authorized installer in accordance with manufacturer's instructions.
 - 2. Install architectural film surfacing without gaps.
 - 3. Remove air bubbles, wrinkles, blisters, and other defects.

3.5 CLEANING

- A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended in writing by wall-covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

SECTION 099114

EXTERIOR PAINTING (MPI STANDARDS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Surface preparation and application of paint systems on the following exterior substrates:
 - a. Concrete masonry units (CMUs).
 - b. Steel and iron.
 - c. Galvanized metal.
 - d. Gypsum board.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates.
2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
3. Section 055119 "Metal Grating Stairs" for shop priming metal grating stairs.
4. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings.

1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.
 2. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 3. Indicate VOC content.
- B. Samples: For each type of topcoat product.
- C. Samples for Initial Selection: For each type of topcoat product.
- D. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
1. Submit Samples on rigid backing, 8 inches square.
 2. Apply coats on Samples in steps to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- E. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in the Exterior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Design Professional will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Design Professional will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Design Professional at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Design Professional specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the

completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Behr Paint Company; Behr Process Corporation
 - 2. Benjamin Moore & Co.
 - 3. Coronado Paint; Benjamin Moore & Co.
 - 4. PPG Paints; PPG Industries, Inc.
 - 5. Pratt & Lambert; a subsidiary of The Sherwin-Williams Company
 - 6. Valspar; a brand of The Sherwin-Williams Company
- B. Source Limitations: Obtain paint from single source from single manufacturer.
- C. MPI Standards: Provide products complying with MPI standards indicated and listed in its "MPI Approved Products List."
- D. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- E. VOC Content: For field applications, paints and coatings shall comply with VOC content limits

of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Dry-Fog Coatings: 150 g/L.
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Rust-Preventive Coatings: 100 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Shellacs, Clear: 730 g/L.
9. Shellacs, Pigmented: 550 g/L.

- F. Colors: Match Design Professional's samples.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
 2. Fiber-Cement Board: 12 percent.
 3. Masonry (Clay and CMUs): 12 percent.
 4. Wood: 15 percent.
 5. Portland Cement Plaster: 12 percent.
 6. Gypsum Board: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 2.
 - 2. SSPC-SP 3.
 - 3. SSPC-SP 7/NACE No. 4.
 - 4. SSPC-SP 11.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 - 2. Sand surfaces that will be exposed to view, and remove sanding dust.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 INSTALLATION

- A. Apply paints in accordance with manufacturer's written instructions and recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in the Exterior Painting Schedule may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, Contractor shall pay for testing and apply additional

coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 - 3. Allow empty paint cans to dry before disposal.
 - 4. Collect waste paint by type and deliver to recycling or collection facility.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Design Professional, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. CMU Substrates:
 - 1. Latex System MPI EXT 4.2A:
 - a. Prime Coat: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Low-Sheen Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.
 - d. Semigloss Topcoat: Latex, exterior, semigloss (MPI Gloss Level 5), MPI #11.
 - e. Gloss Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.
- B. Steel and Iron Substrates:
 - 1. Water-Based Light Industrial Coating System:
 - a. Shop Prime Coat: Shop primer specified in Section where substrate is specified.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Low-Sheen Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.
 - d. Semigloss Topcoat: Light industrial coating, exterior, water based, semigloss (MPI

- Gloss Level 5), MPI #163.
- e. Gloss Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), MPI #164.

C. Galvanized-Metal Substrates:

- 1. Latex System MPI EXT 5.3A:
 - a. Water-Based Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Flat Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.
 - d. Low-Sheen Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.
 - e. Semigloss Topcoat: Latex, exterior, semigloss (MPI Gloss Level 5), MPI #11.
 - f. Gloss Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.

END OF SECTION 099114

SECTION 099124

INTERIOR PAINTING (MPI STANDARDS)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Surface preparation of substrates and application of the following:
 - 1. Interior paint systems.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
 - 2. Section 055213 "Pipe and Tube Railings" for shop painting pipe and tube railings.
 - 3. Section 099114 "Exterior Painting (MPI Standards)."

1.2 DEFINITIONS

- A. MPI Gloss Level G1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, in accordance with ASTM D523.
- B. MPI Gloss Level G2: Not more than 10 units at 60 degrees and between 10 to 35 units at 85 degrees, in accordance with ASTM D523.
- C. MPI Gloss Level G3: Between 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, in accordance with ASTM D523.
- D. MPI Gloss Level G4: Between 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, in accordance with ASTM D523.
- E. MPI Gloss Level G5: Between 35 to 70 units at 60 degrees, in accordance with ASTM D523.
- F. MPI Gloss Level G6: Between 70 to 85 units at 60 degrees, in accordance with ASTM D523.
- G. MPI Gloss Level G7: More than 85 units at 60 degrees, in accordance with ASTM D523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Include preparation requirements and application instructions.

3. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat. Submit actual paint drawdowns as specified below for verification Samples.
 1. Submit Samples on rigid backing, 8 inches square.
 2. Apply coats on Samples in steps to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match paint products applied 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 MOCKUPS

- A. Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 1. Design Professional will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Design Professional will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Design Professional at no added cost to Engineer.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations by Change Order.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each paint product from single source from single manufacturer.

2.2 INTERIOR PAINTS, GENERAL

- A. Interior Paint Systems: Subject to compliance with requirements, provide one of the products listed in the applicable interior painting schedule articles for the paint category indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Benjamin Moore & Co.
 - b. Sherwin-Williams Company (The)
 - c. The Pittsburgh Paints Company
- B. MPI Standards: Provide products complying with MPI standards indicated in applicable interior painting schedule articles and listed in the "MPI Approved Products List."
- C. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products must be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

- D. Colors: As indicated in a color schedule on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
 2. Cementitious Composition Board: 12 percent.
 3. Masonry (Clay and CMUs): 12 percent.
 4. Wood: 15 percent.
 5. Gypsum Board: 12 percent. Verify that finishing compound is dry and sanded smooth.
 6. Plaster: 12 percent. Verify that plaster is fully cured.
- C. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove loose rust, loose mill scale, loose shop primer, and other loose foreign matter. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 3.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized Metal Substrates: Remove grease and oil residue from galvanized metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for interior use in paint system indicated.
 - 2. Sand surfaces that will be exposed to view and remove sanding dust.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION OF INTERIOR PAINT PRODUCTS

- A. Apply paints in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in applicable interior painting schedule articles may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.

- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed to view in equipment rooms:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 2. Paint the following work where exposed to view in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Design Professional.
 - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.

2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 3. Allow empty paint cans to dry before disposal.
 4. Collect waste paint by type and deliver to recycling or collection facility.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Design Professional, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE, MASONRY SUBSTRATES

A. CMU Substrates:

1. Latex System: MPI INT 4.2A.
 - a. Prime Coat: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, (MPI Gloss Level G4), MPI #43 semigloss (MPI Gloss Level G5), MPI #54 gloss (MPI Gloss Level G6, except minimum gloss of 65 units at 60 degrees), MPI #114.

3.6 INTERIOR PAINTING SCHEDULE, METAL SUBSTRATES

A. Steel and Iron Substrates:

1. Latex System, Alkyd Primer: MPI INT 5.1Q.
 - a. Shop-Applied Prime Coat: Shop primer specified in Section where substrate is specified.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, (MPI Gloss Level G3), MPI #52 semigloss (MPI Gloss Level G5), MPI #54 gloss (MPI Gloss Level G6, except minimum gloss of 65 units at 60 degrees), MPI #114.
2. Latex over Shop-Applied Quick-Drying Shop Primer System: MPI INT 5.1X.
 - a. Prime Coat: Primer, quick dry, for shop application, MPI #275.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, (MPI Gloss Level G3), MPI #52 semigloss (MPI Gloss Level G5), MPI #54 gloss (MPI Gloss Level G6, except minimum gloss of 65 units at 60 degrees), MPI #114.

3.7 INTERIOR PAINTING SCHEDULE, GYPSUM-BASED SUBSTRATES

A. Gypsum Board and Plaster Substrates:

1. Latex over Latex Sealer System: MPI INT 9.2A.
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level G1), MPI #53 (MPI Gloss Level G3), MPI #52 semigloss (MPI Gloss Level G5), MPI #54 gloss (MPI Gloss Level G6, except minimum gloss of 65 units at 60 degrees), MPI #114.

END OF SECTION 099124

SECTION 101100
VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Visual display board assemblies.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Visual display board assemblies.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

C. Shop Drawings: For visual display units.

1. Include plans, elevations, sections, details, and attachment to other work.
2. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
3. Include sections of typical trim members.

D. Product Schedule: For visual display units. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each visual display unit, for tests performed by a qualified testing agency.

C. Sample Warranties: For manufacturer's special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For visual display units and motorized units to include in

maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Surfaces lose original writing and erasing qualities.
 - b. Surfaces exhibit crazing, cracking, or flaking.
 - 2. Warranty Period:
 - a. Life of the building.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.

2.2 VISUAL DISPLAY BOARD ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Claridge Products and Equipment, LLC.
2. Egan Visual
3. Peter Pepper Products, Inc
4. PolyVision Corporation

B. Visual Display Board Assembly: factory fabricated.

1. Assembly: markerboard.
2. Corners: Square.
3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.
5. Mounting Method: Direct to wall.

C. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.

1. Color: White.

D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; standard size and shape.

1. Aluminum Finish: Clear anodic finish.

E. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.

F. Chalktray: Manufacturer's standard; continuous.

1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

2.3 MARKERBOARD PANELS

A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with low-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.

1. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisture-barrier backing.
2. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

2.4 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

1. Hardwood Plywood: 0.05 ppm.
2. Particleboard: 0.09 ppm.

3. MDF More Than 5/16 Inch (8 mm) Thick: 0.11 ppm.
4. MDF 5/16 Inch (8 mm) or Less in Thickness: 0.13 ppm.

- B. Extruded Aluminum: ASTM B221, Alloy 6063.
- C. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 099123 "Interior Painting" and recommended in writing by visual display unit manufacturer for intended substrate.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA AMP 500 for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation and backing for visual display units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings,

cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

- D. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

3.3 INSTALLATION

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Factory-Fabricated Visual Display Board Assemblies:
 - 1. Adhere to wall surfaces with egg-size adhesive gobs at 16 inches o.c., horizontally and vertically.

3.4 CLEANING AND PROTECTION

- A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

SECTION 101423.16

ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes room-identification signs that are directly attached to the building.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Room-Identification Signs: Full-size Sample.
2. Exposed Accessories: of each accessory type.
3. Full-size Samples, if approved, will be returned to Contractor for use in Project.

- E. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Variable Component Materials: 12 replaceable text inserts and interchangeable characters (letters, numbers, and graphic elements) of each type.
 2. Tools: One set(s) of specialty tools for assembling signs and replacing variable sign components.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer of products.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in ICC A117.1.

2.2 ROOM-IDENTIFICATION SIGNS

- A. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ACE Sign Systems, Inc.
 - b. ASE, Inc.
 - c. ASI Sign Systems, Inc.
 - d. Advance Corporation.
 - e. Mohawk Sign Systems.
 - f. Signature Signs, Inc.
 - g. Vista System, LLC.
 - h. inpro Corporation.
 2. Laminated-Sheet Sign: Acrylic with raised graphics laminated to acrylic backing sheet to produce composite sheet.
 - a. Composite-Sheet Thickness:
 - 1) Non-Insert Sign: 1/4-inch clear acrylic panel over 1/8-inch white acrylic back panel which is 1/8-inch shorter on all sides.
 - 2) Insert Sign for Clear Matte Film: 1/4-inch clear acrylic panel over 1/16-inch acrylic spacer over 1/4-inch clear acrylic panel over 1/8-inch white acrylic back panel which is 1/8-inch shorter on all sides.
 - 3) Insert Sign for Magnetic strips: 1/4-inch clear acrylic panel over 1/16-inch magnetic sheeting spacer over 1/4-inch clear acrylic panel over 1/8-inch white acrylic back panel which is 1/8-inch shorter on all sides.
 - b. Color(s): As selected by Design Professional from manufacturer's full range.
 3. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: Square Cut.
 - b. Corner Condition in Elevation: Square.
 4. Mounting: Surface mounted to wall with two-face tape.
 5. Text and Typeface: As indicated on the drawings.

2.3 SIGN MATERIALS

- A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- B. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings.
- C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
- B. Adhesive: As recommended by sign manufacturer.
- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- C. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:

1. For snap-in changeable inserts beneath removable face sheet, furnish one suction or other device to assist in removing face sheet. Furnish initial changeable insert. Subsequent changeable inserts are by Engineer.
- D. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
 1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match Design Professional's sample. color unless otherwise indicated.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.
- C. Mounting Methods:
 1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

3.2 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Engineer.

END OF SECTION 101423.16

SECTION 102113.17

PHENOLIC-CORE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for blocking.
2. Section 092216 "Non-Structural Metal Framing" for blocking.
3. Section 102800 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

1.2 COORDINATION

- A. Coordinate requirements for overhead supports, blocking, reinforcing, and other supports concealed within wall and ceiling to ensure that toilet compartments can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

A. Product Data.

1. Phenolic-core toilet compartments.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.
5. Show ceiling grid, ceiling-mounted items, and overhead support or bracing locations.

- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment.

1. Include Samples of hardware and accessories involving material and color selection.
- D. Samples for Verification: Actual sample of finished products for each type of toilet compartment, hardware, and accessory.
 1. Size: Manufacturers' standard size.
- E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.
- F. Delegated Design Submittals: For grab bars mounted on toilet compartment panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For toilet compartments.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Materials: Furnish extra materials to Engineer that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Door Hinges: One hinge(s) with associated fasteners.
 2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.
 3. Door Bumper: One door bumper(s) with associated fasteners.
 4. Door Pull: One door pull(s) with associated fasteners.
 5. Fasteners: 10 fasteners of each size and type.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain phenolic-core toilet compartments from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:
 - 1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf applied at any direction and at any point, without deformation of panel.
- C. Regulatory Requirements: Comply with applicable provisions in ICC A117.1 for toilet compartments designated as accessible.

2.3 PHENOLIC-CORE TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Sanitary Partition Corporation
 - 2. ASI Accurate Partitions
 - 3. ASI Global Partitions
 - 4. Bobrick Washroom Equipment, Inc
 - 5. Bradley Corporation
- B. Toilet-Enclosure Style: Overhead braced.
- C. Urinal-Screen Style: Wall hung.
- D. Door, Panel, and Pilaster Construction: Solid phenolic-core material with melamine facing on both sides fused to substrate during manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch- thick doors and pilasters and minimum 1/2-inch-thick panels.
- E. Urinal-Screen Construction: Matching panel construction.
- F. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- G. Urinal-Screen Post: Manufacturer's standard post design of material matching the thickness and construction of pilasters; with shoe matching that on the pilaster.
- H. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets, stainless steel.

- I. Phenolic Compartment Finish: One color in each room.
 - 1. Through-Color Phenolic: Manufacturer's standard solid through-color.
 - a. Color: As indicated on the drawings.

2.4 HARDWARE AND ACCESSORIES

- A. Door Hardware and Accessories: Manufacturer's operating hardware and accessories. Mount with through bolts.
 - 1. Hinges: Manufacturer's stainless steel continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door.
 - 2. Latch and Keeper: Manufacturer's standard stainless steel, surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.
 - 3. Coat Hook: Manufacturer's standard stainless steel combination hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories.
 - 4. Door Bumper: Manufacturer's standard stainless steel, rubber-tipped bumper at outswinging doors.
 - 5. Door Pull: Manufacturer's standard stainless steel pull at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.5 MATERIALS

- A. Aluminum Castings: ASTM B26/B26M.
- B. Aluminum Extrusions: ASTM B221.
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless Steel Castings: ASTM A743/A743M.

2.6 FABRICATION

- A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, inswinging doors for standard toilet enclosures and 36-inch- wide, outswinging doors with a minimum 32-inch- wide, clear opening for toilet enclosures designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels or Screens: 1/2 inch.
 - b. Panels or Screens and Walls: 1 inch.
 - 2. Stirrup Brackets: Secure panels or screens to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.

- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.17

SECTION 102600

WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Corner guards.

B. Related Requirements:

1. Section 087100 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.

1. Include Samples of accent strips and accessories to verify color selection.

D. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches long. Include example top caps.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type of exposed plastic material.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.
 - 1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than Insert number and size 96-inch- long units.
 - 2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 - 2. Keep plastic materials out of direct sunlight.
 - 3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
 - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing 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: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in ICC A117.1.

2.2 CORNER GUARDS

- A. Surface-Mounted, Opaque-Plastic Corner Guards: Fabricated as one piece from PVC-free plastic; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. inpro Corporation
 - b. JL Industries; Activar Construction Products Group, Inc.
 - c. Koroseal Interior Products, LLC
 - d. Pawling Corporation
 - 2. Wing Size: Nominal 2-1/2 by 2-1/2 inches.
 - 3. Mounting: Countersunk screws through factory-drilled mounting holes.
 - 4. Color and Texture: As selected by Design Professional from manufacturer's full range.

2.3 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
 - 1. Hardwood Plywood: 0.05 ppm.
 - 2. Particleboard: 0.09 ppm.
 - 3. MDF More Than 5/16 Inch Thick: 0.11 ppm.
 - 4. MDF 5/16 Inch or Less in Thickness: 0.13 ppm.
- B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- C. Adhesive: As recommended by protection product manufacturer.

2.4 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.5 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.
- C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
 - 1. Provide anchoring devices and suitable locations to withstand imposed loads.
 - 2. Adjust top caps as required to ensure tight seams.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Custodial accessories.

B. Related Requirements:

1. Section 093013 "Ceramic Tiling" for ceramic toilet and bath accessories.

1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 ACTION SUBMITTALS

A. Product Data: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

C. Delegated Design Submittals: For grab bars.

1. Include structural design calculations indicating compliance with specified structural-

performance requirements.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Structural Performance: Design accessories and fasteners to comply with the following requirements:
 - 1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer unless otherwise noted.
- B. Toilet Tissue (Roll) Dispenser (TPD):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc
 - c. Bradley Corporation

d. AJW Architectural Products

2. Description: Double-roll dispenser.
3. Mounting: Surface mounted.
4. Operation: Noncontrol delivery with standard spindle.
5. Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Paper Towel (Roll) Dispenser (PTD):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASI-American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc
 - c. Bradley Corporation
 - d. AJW Architectural Products
2. Description: Touch-free pull towel dispenses on 12-inch length of towel per pull and operates smoothly and quietly. User only touches the paper.
3. Mounting: Surface mounted.
4. Minimum Capacity: 8-inch- wide, 800-foot- long roll.
5. Material and Finish: ABS plastic, gray, with translucent front cover.
6. Lockset: Tumbler type.

D. Automatic Soap Dispenser (SD):

1. Description: Automatic dispenser with infrared sensor to detect presence of hands; battery powered; designed for dispensing soap in lather form.
2. Mounting: Surface mounted.
3. Materials: ABS Plastic.
4. Refill Indicator: LED indicator.
5. Low-Battery Indicator: LED indicator.

E. Grab Bar (GBXX):

1. Mounting: Flanges with concealed fasteners.
2. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
3. OD: 1-1/2 inches.
4. Configuration and Length: As indicated on Drawings.

F. Sanitary-Napkin Disposal Unit (SND):

1. Mounting: Surface mounted.
2. Door or Cover: Self-closing, disposal-opening cover.
3. Receptacle: Removable.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

G. Mirror Unit (MX):

1. Frame: Stainless steel angle, 0.05 inch thick.
 - a. Corners: Mitered and mechanically interlocked.
2. Size: As indicated on Drawings.

H. Hook (H):

1. Description: Single-prong unit.
2. Mounting: Exposed.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.3 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Shower Curtain Rod (SCX):

1. Description: 1-1/4-inch- OD, straight rod.
2. Configuration: As indicated on Drawings.
3. Mounting Flanges: Exposed fasteners; in material and finish matching rod.
4. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

B. Shower Curtain (SCX):

1. Size: Minimum 12 inches wider than opening by 72 inches high.
2. Material: Vinyl, minimum 0.006 inch thick, opaque, matte.
3. Color: White.
4. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
5. Shower Curtain Hooks: Chrome-plated or stainless steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

C. Towel Hook (TH):

1. Description: Double-prong unit.
2. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.4 CUSTODIAL ACCESSORIES

A. Custodial Mop and Broom Holder (CS):

1. Description: 22-gauge stainless steel coat hook wall rack. Backplate is open through the center and does not have end caps.
2. Length: Manufacturer's standard length for six hooks, minimum width of 36-inches..
3. Hooks: Six 14-gauge double hooks.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.5 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch- minimum nominal thickness.
- C. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.
- D. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.
- F. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.6 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Engineer's representative.

PART 3 - EXECUTION

3.1 INSTALLATION OF TOILET, BATH, AND LAUNDRY ACCESSORIES

- A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
 - 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 102800

SECTION 104416
FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Babcock-Davis
 - b. Badger Fire Protection; a Carrier company
 - c. Buckeye Fire Equipment Company
 - d. Guardian Fire Equipment, Inc
 - e. JL Industries; Activar Construction Products Group, Inc.
 - f. Larsen's Manufacturing Company
 - 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
 - 3. Valves: Manufacturer's standard.
 - 4. Handles and Levers: Manufacturer's standard.
 - 5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type in Steel Container (FE-1): UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
- C. Purple-K Dry-Chemical Type in Aluminum Container (FE-2): UL-rated 30-B:C, 5-lb nominal capacity, with potassium bicarbonate-based dry chemical in enameled-aluminum container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
 - 1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Design Professional.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
 - 1. Mounting Height: Top of fire extinguisher to be at 42 inches above finished floor.

END OF SECTION 104416

SECTION 105113

METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Welded athletic lockers.
 - 2. Locker benches.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

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 metal locker and bench.
- B. Shop Drawings: For metal lockers.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show locker trim and accessories.
 - 3. Include locker identification system and numbering sequence.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.
- D. Samples for Verification: For the following products, in manufacturer's standard size:
 - 1. Lockers and equipment.
 - 2. Locker benches.
- E. Product Schedule: For lockers. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. The following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:
 - a. Locks.
 - b. Blank identification plates.
 - c. Hooks.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Welded Metal Lockers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain metal lockers, locker benches, and accessories from single source from single locker manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: For lockers and locker benches indicated to be accessible, comply with applicable provisions in ICC A117.1.

2.3 WELDED ATHLETIC LOCKERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Space Saver, Free Style or comparable product by one of the following:
 1. Lyon LLC
 2. Penco Products, Inc.
- B. Doors: One piece; fabricated from 0.075-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
 1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors with more than 15 inches wide; welded to inner face of doors.
 2. Door Style: Vented panels as follows:
 - a. Louvered Vents: No fewer than six louver openings at top and bottom.
- C. Body: Assembled by welding body components together, riveting of structural members will not be permitted. Fabricate from unperforated steel sheet with thicknesses as follows:
 1. Tops and Bottoms: 0.048-inch nominal thickness, with single bend at edges.
 2. Backs: 0.048-inch nominal thickness.
 3. Horizontal front flanges will be a minimum of 2 inches. Vertical front flanges will be a minimum 1 inch. Horizontal and vertical flanges will overlap and be secured with a minimum two resistance welds per corner.
 4. Corner gussets shall be MIG and spot welded in each of the four front corners of the locker for increased stiffness and rigidity.
 5. Provide side panels lances every space on 3 inch centers. Lances to provide the flexibility of on-site, end-user reconfiguration internal components anytime.

- D. Bench Housing: Built-in bench drawer.
1. Welded frame construction shall consist of top, bottom, and side components joined by using resistance welding. Riveting of bench housing structural members will not be permitted.
 2. Corner gussets shall be welded in the two front bottom corners of the bench housing for increased stiffness and rigidity.
 3. Horizontal front flanges will be a minimum of 1 inch.
 4. Vertical front flanges will be a minimum of 1 inch.
 5. Horizontal and Vertical front flanges will overlap and shall be secured with minimum of one resistance with per corner.
 6. Side panels-Lances symmetric and evenly spaced to provide optimum component locations.
 7. Return flanges on housing to securely fasten housing to welded frame of locker.
 8. Base of bench housing shall include four 3/8" 16 UNC threaded weld nuts and corresponding leveling feet.
 9. Top of bench housing shall include hole pattern for mating bench seat.
 10. Sides of bench housing shall include mounting holes for when lockers are ganged together.
 11. Bench top: Solid butcher block maple bench.
- E. Lockers with build-in bench drawer and built-in external access drawer shall have intermediate base shelf with interlocking mechanism for securing drawer when locker is closed.
- F. End Panels: End panels with no exposed fasteners shall be provided on the end of each locker run; thus providing a clean and aesthetically pleasing appearance.
- G. Provide slope top at lockers.
- H. Size: Refer to drawings for locker size and configuration.
- I. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees; self-closing.
1. Continuous Hinges: Manufacturer's standard, steel; side or top mounted as required by locker configuration.
- J. Projecting Turn-Handle and Latch: Steel handle welded to manufacturer's standard, three-point, cremone-type latching mechanism consisting of steel rods or bars that engage locker frame at top and bottom of door, and center latch that engages strike jamb; with steel padlock loop.
- K. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.
- L. Interior components: All interior components must be constructed of minimum 18-gauge steel.
1. Adjustable Shelves: Plain; Uniform load rating 100 pounds with integral garment hanger.
 2. Three- hook bracket- Manufacturer's adjustable hook bracket with three hooks.

- M. Continuous Sloping Tops: Fabricated from 0.048-inch nominal-thickness steel sheet, with a pitch of approximately 20 degrees.
 - 1. Closures: Hipped-end type.
- N. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.
- O. Finished End Panels: Fabricated from 0.024-inch nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
- P. Materials:
 - 1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
- Q. Finish: Baked enamel or powder coat.
 - 1. Color: As indicated on the drawings.

2.4 LOCKER BENCHES

- A. Provide bench units with overall assembly height of 17-1/2 inches.
- B. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.
 - 1. Size: Minimum 9-1/2 inches wide by 1-1/4 inches thick.
 - 2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.
- C. Fixed-Bench Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:
 - 1. Tubular Steel:
 - a. 1-1/2-inch- diameter steel tubing threaded on both ends, with standard pipe flange at top and bell-shaped cast-iron base; with baked-enamel or powder-coat finish; anchored with exposed fasteners.
 - b. Color: Match metal lockers.
- D. Materials:
 - 1. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304.
 - 2. Steel Tube: ASTM A500/A500M, cold rolled.

2.5 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents

or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
- C. Equipment: Provide each locker with an identification plate and the following equipment:
- D. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.
- E. Accessible Lockers: Fabricate as follows:
1. Locate bottom shelf no lower than 15 inches above the floor.
 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.
- F. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
- G. Boxed End Panels: Fabricated with 1-inch- wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.
1. Provide one-piece panels for double-row (back-to-back) locker ends.
- H. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
1. Provide one-piece panels for double-row (back-to-back) locker ends.
- I. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.6 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.
1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lockers level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
 - 2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
 - 3. Anchor back-to-back metal lockers to floor.
- B. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.
- C. Equipment:
 - 1. Attach door locks on doors using security-type fasteners.
 - 2. Identification Plates: Identify metal lockers with identification indicated on Drawings.
 - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
 - 1. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
 - 2. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.
- E. Fixed Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.
- F. Movable Benches: Place benches in locations indicated on Drawings.

3.3 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

3.4 PROTECTION

- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 105613
METAL STORAGE SHELVING

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. Four-post rolling metal storage shelving.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal storage shelving.
- B. Shop Drawings: For metal storage shelving.
 - 1. Include plans, elevations, and sections

1.4 INFORMATIONAL SUBMITTALS.

- A. Product Certificates: For each type of metal storage shelving.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal storage shelving to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Shelves: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 5 shelves.
2. Shelf-to-Post Connectors: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 10 connectors.
3. Ledges: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 5 ledges.
4. Liners: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 5 liners.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install metal storage shelving until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for building occupants during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 FOUR-POST METAL STORAGE SHELVING

- A. Wire-Type, Four-Post Metal Storage Shelving: Complying with MH 28.1; field assembled from factory-formed components. Shelves span between supporting corner posts that allow shelf-height adjustment over full height of shelving unit. Provide fixed top and bottom shelves, adjustable intermediate shelves, and accessories indicated. Provide shelving that is equal to or greater in quality to Basis of Design Uline model H-9486 and with ledge accessory models H-6180 and H-6182 and liner accessory model H-2440.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adjustable Shelving; Karp Associates, Inc.
 - b. Durham Manufacturing Company (The).
 - c. Lyon Workspace Products, LLC.
 - d. Penco Products, Inc.
 - e. Republic Storage Systems, LLC.
 - f. Spacesaver Corporation.
 2. Load-Carrying Capacity per Shelf: 200 lb.
 3. Posts: Fabricated from 1-inch OD, round tubing of indicated material; with grooves or notches at 1 inch o.c. to receive shelf-to-post connectors. Label posts with numbers at not less than 2 inches o.c. for determining shelf height.
 4. Unit Configuration: Configure shelving units as individual, freestanding assemblies.

5. Framed-Type Wire Shelves: Stainless-steel wire-over-wire construction, with shelf frame fabricated from same material and with same finish as posts; with manufacturer's standard post collar, designed to engage collet (wedge), welded at each corner.
6. Shelf Quantity: Two shelves per shelving unit in addition to top and bottom shelf.
7. Shelf-to-Post Connectors: Manufacturer's standard connectors.
8. Overall Unit Width: 48"
9. Overall Unit Depth: 24"
10. Overall Unit Height: 69"
11. Steel Finish: stainless steel type 304

2.2 CASTERS

- A. Casters: 5" stainless steel, locking swivel casters.

2.3 FABRICATION

- A. Fabricate metal storage shelving components to provide field-assembled units that are square and rigid, with posts plumb and true and shelves flat and free of dents or distortion. Fabricate connections to form a rigid structure, free of buckling and warping.
 1. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
 2. Build in straps, plates, brackets, and other reinforcements as needed to support shelf loading.
 3. Cut, reinforce, drill, and tap metal fabrications to receive hardware, fasteners, and similar items.
- B. Form metal in maximum lengths to minimize joints. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work. Form backs of shelving units of up to 48 inches wide from one piece.
- C. Form edges and corners free of sharp edges or rough areas. Fold back and crimp exposed edges of unsupported sheet metal to form a hem on the concealed side; ease edges of metal plate to radius of approximately 1/32 inch. Shear and punch metals cleanly and accurately. Remove burrs.
- D. Weld corners and seams continuously to develop strength, minimize distortion, and maintain the corrosion resistance of base metals. At exposed locations, finish welds and surfaces smooth and blended so surface is smooth after finishing and contour of welded surface matches that of adjacent surface. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces before finishing.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Vacuum and clean finished floor over which metal storage shelving is to be installed.

3.2 INSTALLATION

- A. Accessories:
 - 1. Ledges: Install on 3 side of shelf, one back and both sides.
 - 2. Liners: Install one liner per shelf.

3.3 ADJUSTING

- A. Adjust and lubricate operable components to operate smoothly and easily, without binding or warping. Check and readjust operating hardware.
- B. Touch up marred finishes or replace metal storage shelving that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal storage shelving manufacturer.
- C. Replace metal storage shelving components that have been damaged beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 105613

SECTION 113013
RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cooking appliances.
2. Kitchen exhaust ventilation.
3. Refrigeration appliances.
4. Cleaning appliances.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for kitchen sinks, dishwasher air-gap fittings, waste (garbage) disposers, and instant hot-water dispensers.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

- B. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of appliance.

C. Field quality-control reports.

D. Sample Warranties: For manufacturers' special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 WARRANTY

- A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Electric Cooktop and Range: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on surface-burner elements.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- C. Microwave Oven: Full warranty, including parts and labor, for on-site service
 - 1. Warranty Period: Two years from date of Substantial Completion.
- D. Refrigerator/Freezer, Freezer, and Icemaker, Sealed System: Full warranty, including parts and labor, for on-site service on the product.
 - 1. Warranty Period for: Two years from date of Substantial Completion.
- E. Clothes Washer: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on the product.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of residential appliance from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in ICC A117.1.

2.3 COOKING APPLIANCES

A. Electric Range (A7): Freestanding range with one oven(s) and complying with AHAM ER-1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. GE Appliances; Haier Group
 - b. LG Electronics USA, Inc.; LG Electronics Inc.
 - c. Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC)
2. Width: 30 inches.
3. Electric Burner Elements: Four.
 - a. Coil Type: Manufacturer's standard.
 - b. Controls: Digital panel controls, located on front.
4. Oven Features:
 - a. Capacity: Minimum 3.3 cu. ft.
 - b. Operation: Baking.
 - c. Broiler: Located in top of oven.
 - d. Oven Door(s): Counterbalanced, removable, with observation window and full-width handle.
 - e. Electric Power Rating:
 - 1) Oven(s): Manufacturer's standard.
 - 2) Broiler: Manufacturer's standard.
 - f. Controls: Digital panel controls and timer display, located on the front.
5. Anti-Tip Device: Manufacturer's standard.
6. Electric Power Supply: 240 V, 60 Hz, 1 phase, 30 A.
7. Material: Porcelain-enameled steel with ceramic-glass cooktop.
 - a. Color/Finish: Black.

B. Microwave Oven (A6):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. LG Electronics USA, Inc.; LG Electronics Inc.
 - b. Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC)
2. Mounting: As indicated on the drawings.
3. Type: Conventional.
4. Dimensions:
 - a. Width: 20 inches.

- b. Depth: 16 inches.
- c. Height: 12 inches.
- 5. Capacity: 1.1 cu. ft.
- 6. Oven Door: Door with observation window and pushbutton latch release.
- 7. Microwave Power Rating: Manufacturer's standard.
- 8. Electric Power Supply: 120 V, 60 Hz, 1 phase, 15 A.
- 9. Controls: Digital panel controls and timer display.
- 10. Other Features: Turntable.
- 11. Material: Porcelain-enameled steel.
 - a. Color/Finish: Black.

2.4 REFRIGERATION APPLIANCES

A. Refrigerator/Freezer (A2): Two-door refrigerator/freezer with freezer on top and complying with AHAM HRF-1.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. LG Electronics USA, Inc.; LG Electronics Inc.
 - b. Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC)
- 2. Type: Freestanding.
- 3. Dimensions:
 - a. Width: 32 inches.
 - b. Depth: 35-1/2 inches.
 - c. Height: 69 inches.
- 4. Storage Capacity:
 - a. Refrigeration Compartment Volume: 14.7 cu. ft.
 - b. Freezer Volume: 5.5 cu. ft.
 - c. Shelf Area: Five adjustable glass shelves.
- 5. General Features:
 - a. Door Configuration: Overlay.
 - b. Dual refrigeration systems.
 - c. Separate touch-pad temperature controls for each compartment.
- 6. Refrigerator Features:
 - a. Interior light in refrigeration compartment.
 - b. Compartment Storage: two vegetable crisper.
 - c. Door Storage: Modular compartments.

7. Freezer Features: One freezer compartment.
 - a. Automatic defrost.
 - b. Interior light in freezer compartment.
 - c. Automatic icemaker and storage bin.
 8. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.
 9. Appliance Color/Finish: White.
- B. Refrigerator/Freezer (A3): Four-door, side-by-side refrigerator/freezer and complying with AHAM HRF-1.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. LG Electronics USA, Inc.; LG Electronics Inc.
 - b. Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC)
 2. Type: Freestanding.
 3. Dimensions:
 - a. Width: 36 inches.
 - b. Depth: 33-1/2 inches.
 - c. Height: 69 inches.
 4. Storage Capacity:
 - a. Refrigeration Compartment Volume: 17.52 cu. ft.
 - b. Freezer Volume: 9.64 cu. ft.
 - c. Shelf Area: Five adjustable glass shelves.
 5. General Features:
 - a. Door Configuration: Overlay.
 - b. Dispenser in door for ice.
 - c. Built-in water-filtration system.
 - d. Dual refrigeration systems.
 - e. Separate touch-pad temperature controls for each compartment.
 6. Refrigerator Features:
 - a. Interior light in refrigeration compartment.
 - b. Compartment Storage: vegetable crisper and meat compartment.
 - c. Door Storage: Modular compartments.
 7. Freezer Features: One freezer compartment.
 - a. Automatic defrost.
 - b. Interior light in freezer compartment.

- c. Automatic icemaker and storage bin.
 - 8. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.
 - 9. Appliance Color/Finish: Black
- C. Refrigerator/Freezer (A4): One-door refrigerator and complying with AHAM HRF-1.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. LG Electronics USA, Inc.; LG Electronics Inc.
 - b. Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC)
 - 2. Type: Undercounter.
 - 3. Dimensions:
 - a. Width: 24 inches.
 - b. Depth: 36-1/4 inches.
 - c. Height: 34inches.
 - 4. Storage Capacity:
 - a. Refrigeration Compartment Volume: 4.9 cu. ft.
 - b. Shelf Area: Three adjustable wire shelves.
 - 5. General Features:
 - a. Door Configuration: Framed with tempered glazing.
 - 6. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.
 - 7. Appliance Color/Finish: Stainless steel.

2.5 CLEANING APPLIANCES

- A. Clothes Washer (A10): Complying with AHAM HLW-1.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. LG Electronics USA, Inc.; LG Electronics Inc.
 - b. Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC)
 - 2. Type: Freestanding, top-loading unit.
 - 3. Dimensions:
 - a. Width: 27 inches.
 - b. Depth: 29 inches.

- c. Height: 45 inches.
 - 4. Drum: Perforated stainless steel.
 - a. Capacity: 5.5 cu. ft..
 - 5. Controls: Rotary-dial controls for water-fill levels, wash/rinse water temperatures, and variable-speed and fabric selectors.
 - a. Wash Cycles: Five wash cycles, including regular, delicate, and permanent press.
 - b. Wash Temperatures: five settings.
 - 6. Electrical Power: 120 V, 60 Hz, 1 phase, 15 A.
 - 7. Motor: Manufacturer's standard with built-in overload protector.
 - 8. Features:
 - a. Agitator: Impeller (without spindle).
 - b. Self-cleaning lint filter.
 - c. Unbalanced-load compensator.
 - d. Inlet Hoses: Minimum length 60 inches.
 - e. Drain Hoses: Minimum length 48 inches.
 - f. Self-leveling legs.
 - g. Automatic dispenser for detergent.
 - h. Spin-cycle safety switch.
 - i. End-of-cycle signal.
 - j. Extra-rinse option.
 - k. Water levels automatically set.
 - 9. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.
 - 10. Appliance Finish: Enamel.
 - a. Color: Black.
- B. Clothes Dryer (A11): Complying with AHAM HLD-1.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. LG Electronics USA, Inc.; LG Electronics Inc.
 - b. Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC)
 - 2. Type: Freestanding, frontloading, electric unit.
 - 3. Dimensions:
 - a. Width: 27 inches.
 - b. Depth: 31 inches.
 - c. Height: .
 - 4. Drum: Perforated stainless steel.

- a. Capacity: 7.3 cu. ft.
- 5. Controls: Touch-pad Rotary-dial controls for drying cycle, temperatures, and fabric selectors.
- 6. Electric-Dryer Power: 240 V, 60 Hz, 1 phase, 30 A.
- 7. Features:
 - a. Removable lint filter.
 - b. Electronic temperature and moisture-level-sensor controls.
 - c. End-of-cycle signal.
 - d. Interior drum light.
 - e. Self-leveling legs.
 - f. Built-in electrical power fuse.
- 8. Appliance Finish: Enamel.
 - a. Color: Black.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF RESIDENTIAL APPLIANCES

- A. Install appliances according to manufacturer's written instructions.

- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
 - 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After installation, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
- B. An appliance will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Engineer's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 113013

SECTION 114000
FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cooking equipment.
 - 2. Self-contained refrigeration equipment.

1.2 COORDINATION

- A. Coordinate foodservice equipment layout and installation with other work, including layout and installation of lighting fixtures, HVAC equipment, and fire-suppression system components.
- B. Coordinate locations and requirements of utility service connections.

1.3 ACTION SUBMITTALS

- A. Product Data
 - 1. Fabricated equipment.
 - 2. Cooking equipment.
 - 3. Self-contained refrigeration equipment.
- B. Include the following:
 - 1. Manufacturer's model number.
 - 2. Accessories and components that will be included for Project.
 - 3. Clearance requirements for access and maintenance.
 - 4. Utility service connections for water, drainage, power, and fuel; include roughing-in dimensions.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For foodservice facilities.
 - 1. Indicate locations of foodservice equipment and connections to utilities.
 - 2. Key equipment using same designations as indicated on Drawings.
 - 3. Include plans and elevations; clearance requirements for equipment access and maintenance; details of equipment supports; and utility service characteristics.

- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For foodservice equipment to include in emergency, operation, and maintenance manuals.
1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Product Schedule: For each foodservice equipment item, include the following:
 - 1) Designation indicated on Drawings.
 - 2) Manufacturer's name and model number.
 - 3) List of factory-authorized service agencies including addresses and telephone numbers.

1.6 WARRANTY

- A. Refrigeration Compressor Warranty: Manufacturer agrees to repair or replace compressors that fail in materials or workmanship within specified warranty period.
1. Failure includes, but is not limited to, inability to maintain set temperature.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF standards.
- B. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.
- C. Regulatory Requirements: Install equipment to comply with the following:
1. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
 2. NFPA 54, "National Fuel Gas Code."
 3. NFPA 70, "National Electrical Code."
 4. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."

2.2 COOKING EQUIPMENT

A. Coffee Urns (A8):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bunn, CWTF 15-2 or comparable product by one of the following:
 - a. Avantco
 - b. Curtis
2. Description: Single urn.
 - a. Capacity: 3 gal. per liner.
 - b. Type: Electric heated.
 - c. Agitator: Push button.
 - d. Spray Arm: Without bypass.
 - e. Timer: Digital.
 - f. Warmers: One upper and one lower warmer.
 - g. Decanter:
 - 1) 12 cup decanter glass black handle.
 - 2) 12 cup decanter glass orange handle.
 - h. Hot Water Faucet: One upper faucet.
 - i. Accessories:
 - 1) Filtering: Disposable filter paper.
 - 2) Finish: Manufacturer's standard.
3. Electrical Service: Equip unit for connection to 120 Volt/13 Amps/1570 watts.
4. Plumbing: 1/4" male flare fitting for 20-90 psi.

2.3 SELF-CONTAINED REFRIGERATION EQUIPMENT

A. Refrigeration Equipment (A1): Refrigerators.

1. Basis-of-Design Product: Subject to compliance with requirements, provide True, STA3R-3S-HC or comparable product by one of the following:
 - a. MoTack
 - b. Beverage-Air
 - c. Continental
2. Description: Reach-in type.
 - a. Exterior Finish: Stainless steel.
 - b. Interior Finish: Manufacturer's standard.
 - c. Doors: Full length.
 - d. Accessories:

- 1) Casters.
- 2) Stainless steel back with rear louvers.
- 3) Re-hinging feature for doors.
- 4) Chrome-Plated Shelves: 4.

e. Electrical Service: Equip unit with plug and cord for 115/60/1 NEMA-5-15R.

B. Ice-Making Machine (A5):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Manitowoc Ice IDT0500A/D520 or comparable product by one of the following:

- a. Ice-O-Matic
- b. Avanto

2. Description: Freestanding units.

- a. Production: Ice cubes.
- b. Capacity: 532 lb per 24-hour period.
- c. Accessories:

1) Storage Bin:

a) Storage Capacity: 532 lb.

- 2) Stainless steel stand and legs.
- 3) Water filter.

d. Electrical Service: Equip unit for connection to 115V.

2.4 MISCELLANEOUS MATERIALS

A. Installation Accessories, General: NSF certified for end-use application indicated.

B. Elastomeric Joint Sealant: ASTM C920; silicone. Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.

1. Public Health and Safety Requirements:

- a. Sealant is certified for compliance with NSF standards for end-use application indicated.
- b. Washed and cured sealant complies with the FDA's regulations for use in areas that come in contact with food.

2. Cylindrical Sealant Backing: ASTM C1330, Type C, closed-cell polyethylene, in diameter greater than joint width.

2.5 FINISHES

A. Stainless Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install foodservice equipment level and plumb, according to manufacturer's written instructions.
 1. Connect equipment to utilities.
- B. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.
- C. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.

3.2 CLEANING AND PROTECTING

- A. After completing installation of equipment, repair damaged finishes.
- B. Clean and adjust equipment as required to produce ready-for-use condition.
- C. Protect equipment from damage during remainder of the construction period.

3.3 DEMONSTRATION

- A. Train Engineer's maintenance personnel to adjust, operate, and maintain foodservice equipment.

END OF SECTION 114000

SECTION 115313

LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bypass fume hoods.
2. Piping and wiring within fume hoods for service fittings, light fixtures, fan switches, and other electrical devices include with the fume hoods.
3. Fume hood base cabinets/stands.
4. Water, laboratory gas, and electrical service fitting in fume hoods.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood blocking for anchoring fume hoods.
2. Section 092216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring fume hoods.
3. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for field quality-control testing of fume hoods.
4. Section 230925 "Laboratory Airflow Control System" for VAV controls for fume hood exhaust.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 COORDINATION

- A. Coordinate layout and installation of framing and reinforcements for lateral support of fume hoods.
- B. Coordinate installation of fume hoods with laboratory casework and other laboratory equipment.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For laboratory fume hoods.

1. Include plans, elevations, sections, and attachment details.
2. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports.
3. Indicate locations and types of service fittings together with associated service supply connection required.
4. Indicate duct connections, electrical connections, and locations of access panels.
5. Include roughing-in information for mechanical, plumbing, and electrical connections.
6. Show adjacent walls, doors, windows, other building components, laboratory casework, and other laboratory equipment. Indicate clearances from the above items.
7. Include layout of fume hoods in relation to lighting fixtures and air-conditioning registers and grilles.
8. Include coordinated dimensions for laboratory equipment specified in other Sections.

C. Samples: For fume hood exterior finishes and interior lining.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Showing compliance with specified performance requirements for as-manufactured containment and static pressure loss, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish complete touchup kit for each type and color of fume hood finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged fume hood finish.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Locate concealed framing, blocking, and reinforcements that support fume hoods by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.9 SOURCE QUALITY CONTROL

- A. Demonstrate fume hood performance before shipment by testing fume hoods according to ASHRAE 110 as modified in "Performance Requirements" Article. Provide testing facility, instruments, equipment, and materials needed for tests.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain laboratory fume hoods from single manufacturer.
- B. Product Designations: Drawings indicate sizes, types, and configurations of fume hoods by referencing designated manufacturer's catalog numbers. Other manufacturers' fume hoods of similar sizes, types, and configurations, and complying with the Specifications, may be considered. See Section 016000 "Product Requirements."

2.2 PERFORMANCE REQUIREMENTS

- A. Containment: Provide fume hoods that comply with the following when tested according to ASHRAE 110 as modified below:
 - 1. As-Manufactured (AM) Rating: AM 0.05 (0.05 ppm).
 - 2. Average Face Velocity: 100 fpm plus or minus 10 percent with sashes fully open.
 - 3. Face-Velocity Variation: Not more than 20 percent of average face velocity across the face opening with sashes fully open.
 - 4. Sash Position: Fully open.
 - a. Test hoods with horizontal sashes with maximum opening on one side, with maximum opening in the center, and with one opening at each side equal to half of maximum opening.
 - b. Test hoods with combination sashes fully raised, with maximum opening on one side, with maximum opening in the center, and with one opening at each side equal to half of maximum opening.
 - 5. Release Rate: 4.0 L/min.
 - 6. Test Setup Modifications: Conduct tests with a minimum of three and a maximum of five people in the test room and with two 1-gal. round paint cans, one 12-by-12-by-12-inch cardboard box, and three 6-by-6-by-12-inch cardboard boxes in the fume hood during the test. Position items from 6 to 10 inches behind the sash, randomly distributed, and supported off the work surface by 2-by-2-inch blocks.
 - 7. Walk-by Test: At the conclusion of containment test, execute three rapid walk-bys at 30-second intervals, 12 inches behind the mannequin. Test-gas concentration during each walk-by to not exceed 0.1 ppm and to return to specified containment value within 15 seconds.

- B. Static-Pressure Loss: Not more than 1/4-inch wg at 75-fpm, and 1/2 -inch wg at 100 and 120 fpm, 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.

2.3 FUME HOODS, GENERAL

- A. Product Standards: Comply with SEFA 1, "Laboratory Fume Hoods - Recommended Practices." Provide fume hoods UL listed and labeled for compliance with UL 1805.
- B. Bypass Fume Hoods: Provide bypass fume hoods. Compensating bypass above the sash opens as sash is located. Provide sufficient bypass capacity so that face velocity with sash opening of 6 inches does not exceed 3 times the face velocity with sash fully open.
- C. Restricted-Bypass Fume Hoods: Provide restricted-bypass fume hoods where indicated. Partial compensating bypass above the sash opens after sash is closed to less than 20 percent open. Design partial bypass to maintain exhaust capacity of at least 25 cfm per sq. ft. of work surface regardless of sash position.

2.4 BYPASS FUME HOODS

- A. Restricted-Bypass Fume Hoods with Steel Exterior:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Master Systems, Corp.
 - b. Kewauneer, Supreme Air Fume Hood, Basis of Design.
 - c. Labcono.
 - d. Mott Manufacturing Ltd.

2.5 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, Type 304, stretcher-leveled standard of flatness.
 - 1. For perchloric acid fume hoods, use Type 316L instead of Type 304.
- C. Epoxy: Factory molded, modified epoxy-resin formulation with smooth, nonspecular finish.
 - 1. Physical Properties:
 - a. Flexural Strength: Not less than 10,000 psi.
 - b. Modulus of Elasticity: Not less than 2,000,000 psi.

- 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 deg F.
 - 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: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
 - b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
- 3. Color: Match Architect's sample of White.
- D. Polypropylene: Unreinforced polypropylene complying with ASTM D4101, Group 01, Class 1, Grade 2.
- E. Glass: Clear, laminated glass complying with ASTM C1172, Kind LT, Condition A, Type I, Class I, Quality-Q3; with two plies not less than 3.0 mm thick and with clear, polyvinyl butyral interlayer.
 - 1. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201 for Category II materials.
 - 2. Permanently mark safety glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label to indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- 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: Provide stainless steel fasteners where exposed to fumes.
 - 1. Exterior structural members' attachments: Sheet metal screws, zinc plated.
 - 2. Interior fastening devices are not acceptable. Conceal interior fastening devices.
 - 3. Exterior panel member fastening devices to be corrosion resistant non-metallic material.
 - 4. Exposed screws not acceptable.

2.6 FABRICATION

- A. General: Assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations. Fume hoods to be capable of being partly disassembled as necessary to permit movement through a 35-by-79-inch door opening.
- B. Steel Exterior: Fabricate from steel sheet, 0.048 inch thick, with component parts screwed together to allow removal of end panels, front fascia, and airfoil and to allow access to

plumbing lines and service fittings. Apply chemical-resistant finish to interior and exterior surfaces of component parts before assembly.

- C. Ends: Fabricate with double-wall end panels without projecting corner posts or other obstructions to interfere with smooth, even airflow. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.
- D. Splay top and sides of face opening to provide an aerodynamic shape to ensure smooth, even flow of air into fume hood.
- E. Interior Lining: Provide one of the following unless otherwise indicated:
 - 1. Stainless steel, not less than 0.050 inch thick with epoxy coating.
 - 2. Phenolic composite, not less than 1/4 inch thick.
 - 3. Polypropylene, not less than 1/4 inch thick.
- F. Lining Assembly: Unless otherwise indicated, assemble with stainless steel fasteners or epoxy adhesive, concealed where possible. Seal joints by filling with chemical-resistant sealant during assembly.
 - 1. Fasten lining components together with stainless steel cleats or angles to form a rigid assembly to which exterior panels are attached.
 - 2. Fasten lining components to a rigid frame assembly fabricated from stainless steel and to which exterior panels are attached.
 - 3. Punch fume hood lining side panels to receive service fittings and remote controls. Provide removable plug buttons for holes not used for indicated fittings.
- G. Rear Baffle: Unless otherwise indicated, provide baffle, of same material as fume hood lining, at rear of hood with openings at top and bottom. Secure baffle to cleats at rear of hood with stainless steel screws. Fabricate baffle for easy removal for cleaning behind baffle.
 - 1. Provide adjustable baffles with control adjustment strips at top and bottom with plastic or stainless-steel knobs.
 - 2. Provide epoxy-coated, stainless-steel screen at bottom baffle opening to prevent paper from being drawn into the exhaust plenum behind baffles.
- H. Exhaust Plenum: Full width of fume hood and with adequate volume to provide uniform airflow from hood, of same material as hood lining, and with duct stub for exhaust connection.
 - 1. Duct-Stub Material: stainless steel.
- I. Bypass Grilles: Provide grilles at bypass openings of fume hoods.
- J. Sashes: Provide operable sashes of type indicated.
 - 1. Fabricate from 0.050-inch-thick stainless steel. Form into four-sided frame with bottom corners welded and finished smooth. Make top member removable for glazing replacement. Set glazing in chemical-resistant, U-shaped gaskets.

2. Glaze with laminated safety glass.
 3. Fabricate horizontal-sliding sashes hung from adjustable nylon-tired, ball-bearing sheaves supported on an overhead stainless steel track. Provide a lower track for guiding sashes only. Sashes to bypass and be removable. Provide flush finger pulls and rubber bumpers at both stiles of each sash.
- K. Airfoil: Unless otherwise indicated, provide airfoil at bottom of fume hood face opening with 1-inch space between airfoil and work top. Sash closes on top of airfoil, leaving 1-inch opening for air intake. Airfoil directs airflow across work top to remove heavier-than-air gases and to prevent reverse airflow.
1. Fabricate airfoil from stainless steel.
- L. Light Fixtures: Provide UL listed, high-efficiency, quick-start, LED lighting systems, including bulbs.
1. Vapor-proof: All electrical components shall be outside of the contaminated air space. Lighting shall be located behind laminated safety glass shield, sealed to the top of the hood liner.
 2. The LED light assemblies shall be serviceable from outside the fume hood cavity. Without the use of tools.
 3. Light switch to be included on the lower right corner post.
- M. Filler Strips: Provide as needed to close spaces between fume hoods or fume hood base cabinets and adjacent building construction. Fabricate from same material and with same finish as fume hoods or fume hood base cabinets, as applicable.
- N. Ceiling Extensions: Provide 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 ceiling.
- O. Comply with requirements in other Sections for installing water and laboratory gas service fittings, piping, electrical devices, and wiring. Install according to Shop Drawings. Securely anchor fittings, piping, and conduit to fume hoods unless otherwise indicated.

2.7 FUME HOOD SYSTEMS

- A. Comply with Section 123553.13 "Metal Laboratory Casework."
- B. Work Tops: Epoxy.
1. Work-Top Configuration: Raised (marine) edge with beveled edge and corners.
 2. Where acid storage cabinets are indicated beneath fume hoods, provide holes in work tops as need to accommodate cabinet vents.
 3. Where epoxy sinks occur in epoxy work tops, provide integral sinks bonded to tops with invisible joint line.
 4. Where epoxy sinks occur in phenolic-composite work tops, provide drop-in sinks with 1/4-inch thick lip around perimeter of sink.

- C. Cup Sinks: Material and size as indicated.
 - 1. Provide with polypropylene strainers and integral tailpieces.
- D. Fume Hood Base Stands: Welded steel tubing legs, not less than 2 inches square with channel stretchers and aprons. Weld or bolt stretchers to legs and cross-stretchers, and bolt legs to aprons. Provide leveling device welded to bottom of each leg.
 - 1. Structural Performance: Capable of withstanding 50-lb/ft. work top, 75 lb/ft. on work top, plus weight of hood, without permanent deformation or excessive deflection.
 - 2. Knee Space: Provide clear floor space not less than 36 inches wide by 25 inches deep by 27 inches high within fume hood base stands unless otherwise indicated.
 - 3. Leg Shoes: As indicated, open-bottom, slip-on type.

2.8 CHEMICAL-RESISTANT FINISH

- A. General: Prepare, treat, and finish welded assemblies after welding. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.
- B. Preparation: Clean steel surfaces, other than stainless steel, of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- C. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply fume hood manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
 - 1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8M. Acceptance level for chemical spot test to be no more than four Level 3 conditions.
 - 2. Colors for Fume Hood Finish: As selected by Architect from manufacturer's full range.

2.9 ACCESSORIES

- A. Airflow Indicator: Provide each fume hood with manufacturer's standard airflow indicator of one of the following indicator types:
 - 1. Direct-reading aneroid (Magnehelic-type) gage that measures exhaust duct static pressure of fume hood as an indication of airflow.
 - 2. Thermal anemometer that measures fume hood face velocity and indicates whether it is below normal, normal, or above normal.
 - 3. Thermal anemometer that measures fume hood face velocity and displays data as digital readout.
- B. Sash Alarm: HVAC Contractor will provide.

- C. Sash Stops: Provide fume hoods with sash stops to limit hood opening to 18" height. Sash stops can be manually released to open sash fully for cleaning fume hood and for placing large apparatus within fume hood.
- D. Bypass Grille Blank-off Panels: Provide fume hoods with blank-off grille designed for use with sash stops to reduce exhaust air volume and provide design face velocity with sash at 50 percent open position.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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. Comply with requirements in Section 123553.13 "Metal Laboratory Casework" for installing fume hood base cabinets, work tops, and sinks.

3.3 FIELD QUALITY CONTROL

- A. Field testing shall be done under Section 230593 "Testing, Adjusting, and Balancing for HVAC".

3.4 ADJUSTING AND CLEANING

- A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.
- B. 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.

3.5 FUME HOOD SCHEDULE

A. Bench-Top Fume Hood: Type:

1. Exterior: Steel with chemical-resistant finish.
2. Ventilation Type: Bypass.
3. ASHRAE 110 As-Manufactured (AM) Rating: AM 0.05 (0.05 ppm)
4. ASHRAE 110 As-Installed (AI) Rating: AI 0.05 (0.05 ppm)
5. Sash Configuration:
 - a. Operation:
 - 1) Vertical-sliding, single-hung sash.
 - b. Opening Height: 27 to 30 inches.
6. Work Top: Epoxy.
7. Cup Sinks: As indicated on the drawings.
8. Service Fittings:
 - a. Water: One, remote-control, rigid, gooseneck, single-service faucet(s) with vacuum breaker and removable serrated outlet.
 - b. Electrical: One duplex receptacle end(s) of hood, mounted on exterior front face of end pilaster.
 - 1) Provide GFCI receptacles.

END OF SECTION 115313

SECTION 123553.13

METAL LABORATORY CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal laboratory casework.
2. Auxiliary cabinets.
3. Countertops.
4. Laboratory casework systems.
5. Laboratory accessories.
6. Water and laboratory gas service fittings.
7. Electrical and communication service fittings.
8. Laboratory glassware washer.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood blocking for anchoring laboratory casework.
2. Section 092216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring laboratory casework.
3. Section 101423 "Panel Signage" for laboratory bench signage.
4. Section 115313 "Laboratory Fume Hoods" for fume hoods, including base cabinets and countertops under fume hoods.
5. Section 224500 "Emergency Plumbing Fixtures" for emergency showers, eyewashes and drench hoses.
6. Division 22 and 26 sections for installing service fittings specified in this Section, including connecting service utilities.
7. Division 26 sections for electrical cover-plate identification.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Engineer, Design Professional, agency representative, casework installer, roofing system manufacturer's representative, installers whose work interfaces with or affects laboratory casework, including plumbing, electrical and HVAC.
2. Review status of submittals
3. Review mock-up requirements
4. Review Inspection requirements
5. Review Environmental requirements for starting and installing casework

6. Review general, mechanical and electrical trades work that are complete prior to installation.
7. Review Protection for casework
8. Review coordination and sequencing of trades
9. Review acceptance of room conditions.

1.3 COORDINATION

- A. Coordinate layout and installation of framing and reinforcements for support of laboratory casework.
- B. Coordinate installation of laboratory casework with installation of laboratory equipment.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Glassware washer:
 - a. Include installation details, material descriptions, dimension of individual components, and finishes for each appliance.
 - b. Include rated capacities, operation characteristics, electrical characteristics, and finished accessories.
- B. Shop Drawings: For laboratory casework.
 1. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.
 2. Indicate types and sizes of casework.
 3. Indicate manufacturer's catalog numbers for casework.
 4. Include countertop joints and splash configuration.
 5. Show fabrication details, including types and locations of hardware.
 6. Indicate locations and types of sinks and service fittings. Cross reference product data.
 7. Include details of utility spaces showing supports for conduits and piping.
 8. Include details of support framing system.
 9. Include details of exposed conduits, if required, for service fittings.
 10. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and laboratory equipment.
 11. Include coordinated dimensions for laboratory equipment specified in other Sections.
- C. Samples for Initial Selection: For casework finishes and materials requiring color selection provide physical samples for color selection.
- D. Samples for Verification: For each type of casework, exposed-hardware, and countertop-material finish, in manufacturer's standard sizes.
 1. Base Cabinet: One full-size, 16-inch-wide, finished base cabinet complete with hardware, doors, adjustable shelving, and drawers but without countertop.

2. Full-Size Samples: Maintain at Project site during construction in an undisturbed condition as a standard for judging the completed Work. Unless otherwise indicated, approved sample units may become part of the completed Work if in undisturbed condition at time of Substantial Completion. Notify Design Professional of their locations.
3. One Sample each of lipped shelves.
4. 6-inch-square Samples for each type of countertop material.
5. One of each service fitting specified, complete with accessories and specified finish.
6. One of each type of sink and accessory item specified.
7. One of each type of hardware item specified.
8. One Sample each of utility-space framing.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Test Reports:
 1. Casework: Based on evaluation of comprehensive tests performed by a qualified independent testing agency, indicating compliance of laboratory casework with requirements of specified product standard and system structural performance specified in "Performance Requirements" Article.
 2. Countertop Surface Material: Based on evaluation of comprehensive tests performed by a qualified independent testing agency, indicating compliance of laboratory countertop surface material with requirements specified for chemical and physical resistance.
 3. Detrimental Chemical List: Include list of chemicals detrimental to cabinet finish and epoxy resin.
 4. Manufacturer's warranties show compliance with specification requirements.
- C. Product Certificates: For glassware washer.
- D. Sample Warranties: Fore manufacturer's special warranties.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish complete touchup kit for each type and color of casework finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.
- B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Cabinet Mounting Clips and Related Hardware: Quantity equal to 5 percent of amount installed, but no fewer than 20 of each type.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For glassware washer include operation and maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that produces casework of types indicated for this Project that has been tested by an independent testing agency for compliance with SEFA 8 M, SEFA 7, and SEFA 3.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.10 FIELD CONDITIONS

- A. Field Measurements: Where laboratory casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.
- B. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

1.11 WARRANTY

- A. Special Warranty: Manufacturer' agrees to repair or replace components of the laboratory casework, fittings and accessories that fail in materials or workmanship within specified warranty period.
 - 1. Special Warranty includes the following defect but are not limited to: ruptured, cracked or stained coatings; discoloration or lack of finish integrity; cracking or peeling of finish; slippage, shift, or failure of attachment to wall, floor or ceiling; weld or structural failure; warping or unloaded deflections of components; failure of hardware.
 - 2. Warranty Period: 1 year from date of substantial completion.
- B. Special Warranty, Glassware washer: Special Warranties: Manufacturer agrees to repair or replace appliances or components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain laboratory casework from single source from single manufacturer unless otherwise indicated.
 - 1. Obtain, sinks, accessories, and fitting from casework manufacturer.
 - 2. Glassware washer does not have to be from casework manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. System Structural Performance: Laboratory casework and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:
 - 1. Wall Cabinets (Upper Cabinets): 160 lb/ft.
 - 2. Standard Shelves: 40 lb/sq. ft.
 - 3. Heavy Duty Shelves: 100 lbs./sq. ft.
- B. Glassware washer: Electrical Appliances Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Accessibility: Where indicated to comply with accessibility requirements, comply with applicable provisions in ICC A117.1.

2.3 CASEWORK, GENERAL

- A. Casework Product Standard: Comply with SEFA 8 M, "Laboratory Grade Metal Casework."
- B. Flammable Liquid Storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements in NFPA 30 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 METAL LABORATORY CASEWORK

- A. Steel Sheet: Unless otherwise indicated, Cold-rolled, commercial steel (CS) sheet, complying with ASTM A1008/A1008M; matte finish; suitable for exposed applications and ASTM A240 type 304 or 316 alloy.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CIF Laboratory Solutions.
2. ICI Scientific.
3. Kewaunee Scientific Corporation, basis of design.
4. Mott Manufacturing Ltd.
5. AMS.

2.5 AUXILIARY CABINETS

- A. Acid Storage-Cabinet Lining: 1/4-inch-thick, polyethylene or polypropylene.

2.6 CABINET HARDWARE

- A. General: Provide laboratory casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.
- B. Hinges: Stainless-steel, five-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two for doors 48 inches high or less and three for doors more than 48 inches high.
- C. Hinged-Door and Drawer Pulls: Basis of design: Kawaunee Steel Cabinet pull style; Pull 1.
- D. Door Catches: Nylon-roller spring catches. Provide two catches on doors more than 48 inches high.
- E. Drawer Slides: ANSI/BHMA A156.9.
 1. Manufacturer's standard.
 2. Heavy Duty (Grade 1HD-100): Side mount.
 - a. Type: Full extension.
 - b. Material: Epoxy-coated polymer slides.
 - c. Motion Feature: Soft close dampener.
 3. General-purpose drawers; provide 100 lb load capacity.
 4. File drawers; provide 150 lb load capacity.
- F. Adjustable Wall Shelf Supports: Surface-type steel standards and steel shelf brackets, with epoxy powder-coated finish, complying with BHMA A156.9, Types B04102 and B04112. Select components and anchorage devices to support uniform live load of 100 pounds per linear foot of shelf.
 1. Support shelves from vertical supports. Vertical positioning of shelves can be varied in 1-inch increments through full height of supports. Provide double slotted supports.
 2. Color and finish to match cabinetry.

2.7 COUNTERTOPS

- A. General: Provide laboratory tabletops, window sills, and countertops with integral shelf and sink as indicated on Drawings.
- B. Epoxy: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Durcon; a Wilsonart Company.
 - b. Prime Industries, Inc.
 - c. Kewaunee
 - d. American Epoxy
 - 2. Physical Properties: Minimum acceptable physical performance in accordance with SEFA 3 testing procedures.
 - a. Flexural Strength: Not less than 10,000 psi.
 - b. Modulus of Elasticity: Not less than 2,000,000 psi.
 - 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 deg F.
 - 3. Color: Black
- C. Phenolic Composite: Solid, high-pressure decorative laminate, complying with NEMA LD 3, Grade CGS.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arborite.
 - b. Formica Corporation.
 - c. Nevamar; a Panolam Industries International, Inc. brand.
 - d. Trespa North America.
 - 2. Chemical Resistance: Composite countertop material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
 - a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), ethyl acetate, ethyl alcohol, formaldehyde (37 percent), furfural, phosphoric acid (85 percent), sulfuric acid (33 percent), toluene.
 - 3. Color: Black.

2.8 METAL CABINET FABRICATION

- A. General: Assemble and finish units at point of manufacture. Use precision dies for interchangeability of like-size drawers, doors, and similar parts. Perform assembly on precision jigs to provide units that are square. Reinforce units with angles, gussets, and channels. Except where otherwise specified, integrally frame and weld cabinet bodies to form dirt- and vermin-resistant enclosures. Where applicable, reinforce base cabinets for sink support. Maintain uniform clearance around door and drawer fronts of 1/16 to 3/32 inch.
- B. Flush Doors: Outer and inner pans that nest into box formation, with full-height channel reinforcements at center of door. Fill doors with noncombustible, sound-deadening material.
 - 1. Basis of Design: Kawneer Steel Cabinet full welded, heavy gage steel, overlay- square edge.
- C. Hinged Doors: Mortise for hinges and reinforce with angles welded inside inner pans at hinge edge.
- D. Drawers: Fronts made from outer and inner pans that nest into box formation, without raw metal edges at top. Sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal. Provide drawers with rubber bumpers, polymer roller slides, and positive stops to prevent metal-to-metal contact or accidental removal.
- E. Adjustable Shelves: Unless noted otherwise on drawings, provide shelves with front, back, and ends formed down, with edges returned horizontally at front and back to form reinforcing channels. Shelves to have a one-inch upturn lip at locations noted on the drawings.
- F. Toe Space: Fully enclosed, 4 inches high by 3 inches deep, with no open gaps or pockets.
- G. Tables: Welded tubing legs, not less than 2 inches square with channel stretchers as needed to comply with product standard. Weld or bolt stretchers to legs and cross-stretchers, and bolt legs to table aprons. Provide leveling device welded to bottom of each leg.
 - 1. Leg Shoes: Black vinyl or rubber or Satin-finished, stainless steel, open-bottom, slip-on type. Refer to drawings for locations.
- H. Utilities: Provide space, cutouts, and holes for pipes, conduits, and fittings in cabinet bodies to accommodate utility services and their support-strut assemblies.
 - 1. Provide base cabinets with removable backs for access to utility space.
- I. Utility-Space Framing: Steel framing units consisting of two steel slotted channels complying with MFMA-4, not less than 1-5/8 inches square by 0.105-inch nominal thickness, that are connected at top and bottom by U-shaped brackets made from 1-1/4-by-1/4-inch steel flat bars. Framing units may be made by welding channel material into rectangular frames instead of using U-shaped brackets.

- J. Filler and Closure Panels: Provide where indicated and as needed to close spaces between casework and walls, ceilings, and equipment. Fabricate from same material and with same finish as casework and with hemmed or flanged edges unless otherwise indicated.
1. Provide knee-space panels (modesty panels) at spaces between base cabinets, where indicated and as required to conceal utilities and framing. Fabricate from back-to-back panels or of hollow construction to eliminate exposed hemmed or flanged edges.
 2. Provide 3-sided fillers at wall cabinets.
 3. Provide 2-sided fillers at tall base cabinets.
 4. Provide 1-sided fillers at base cabinets.
 5. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
 6. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.

2.9 LABORATORY SPECIALTY TABLES

- A. Balance Table: Marble top with pedestal epoxy resin legs, not less than 2-inches thick with a galvanized steel lateral support beam for rigidity.
1. Tabletop Fabrication:
 - a. Table Top Configuration for Balance Table: Flat, 2-inch thick, with beveled edge and corners, and shock and vibration. Isolators sized for 300lbs

2.10 METAL CABINET FINISH FOR COLD ROLLED AND STAINLESS STEEL

- A. General: Prepare, treat, and finish welded assemblies after assembling. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.
- B. Preparation: After assembly, clean surfaces of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to organic coating to be applied over it.
- C. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply laboratory casework manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8 M. Acceptance level for chemical spot test shall be no more than for Level 3 conditions.
 2. Colors for Metal Laboratory Casework Finish: Refer to drawings for color of casework.
 - a. As selected by Design Professional from manufacturer's full range of neutral colors; white; for cabinet base cabinet and wall cabinets and doors, grays at doors where indicated.

- b. Match Design Professional colors for drawer fronts, up to 4 different colors, as indicated on the drawings.

2.11 COUNTERTOP FABRICATION

- A. Countertops, General: Provide units with smooth surfaces in uniform plane, free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch.
- B. Sinks, General: Provide sizes indicated or laboratory casework manufacturer's closest standard size of equal or greater volume, as approved by Design Professional.
 - 1. Outlets: Provide with strainers and tailpieces, NPS 1-1/2, unless otherwise indicated.
- C. Epoxy:
 - 1. Countertops: Fabricate with factory cutouts for sinks, holes for service fittings and accessories, and butt joints assembled with epoxy adhesive and concealed metal splines.
 - a. Flat Configuration: 1 inch thick with continuous drip groove on underside 1/2 inch from overhang edge.
 - 1) Edges and Corners: Beveled.
 - 2) Backsplash: Provide 4 inches high by 1 inch thick applied (butt-joint) backsplashes wherever countertops abut walls or other permanent construction.
 - 3) Provide seams as indicated. Do not provide longitudinal seams.
 - b. Construction: Uniform throughout full thickness.
 - c. Product Option: Phenolic-composite countertops may be substituted for epoxy countertops at Contractor's option.
 - 2. Tabletops:
 - a. Flat Configuration: 1 inch thick with continuous drip groove on underside at perimeter.
 - 1) Edges and Corners: Beveled.
 - b. Tabletop Construction: Uniform throughout full thickness.
 - c. Product Option: Phenolic-composite countertops may be substituted for epoxy countertops at Contractor's option.
 - 3. Sinks: Molded in one piece with smooth surfaces, coved corners, and bottom sloped to outlet; 1/2-inch minimum thickness.
 - a. Provide with polypropylene strainers and tailpieces.

- b. Provide integral sinks in epoxy countertops, bonded to countertops with invisible joint line.
- c. Provide sinks for drop-in installation in phenolic-composite countertops with 1/4-inch-thick lip around perimeter of sink.
- d. Provide sinks for underside installation with manufacturer's recommended adjustable support system for table- and cabinet-type installations.

D. Phenolic Composite:

- 1. Countertops: Fabricate with cutouts for sinks, holes for service fittings and accessories, and butt joints assembled with epoxy adhesive and concealed metal splines.
 - a. Flat Configuration: 1 inch thick with continuous drip groove on underside 1/2 inch from overhang edge and integral coved backsplash.
 - 1) Edges and Corners: Beveled.
- 2. Tabletops:
 - a. Flat Configuration: 1 inch thick with continuous drip groove on underside at perimeter.
 - 1) Edges and Corners: Beveled.

2.12 LABORATORY ACCESSORIES

- A. Reagent Shelves: Provide as indicated, fabricated from same material as adjacent countertop unless otherwise indicated.
- B. Burette Rods: Aluminum or stainless steel rods, 1/2 inch in diameter and 18 inches long, threaded on one end to fit tapered plug adapter for flush socket receptacle. Provide with tapered plug adapter and receptacle.
- C. Upright Rod Assembly and Metal Crossbar: Aluminum or stainless steel. Two vertical rods and one horizontal crossbar, 3/4 inch in diameter and 36 inches long unless otherwise indicated; two flush socket receptacles and two crossbar clamps. Ends of vertical rods are tapered to fit receptacles; other rod ends are rounded.
- D. Greenlaw Arm Assembly: Aluminum or stainless steel vertical rod, tapered on one end to fit flush socket receptacle. Adjustable crossbar of hardwood with black, acid-resistant finish, secured to upright with adjustable clamp. Provide with receptacle.
- E. Lattice Assembly: Aluminum or stainless steel, vertical and horizontal rod lattice assembly with 3/4-inch-diameter rods at approximately 12 inches o.c. with two flush socket receptacles for mounting.
 - 1. Size: 36 inches wide by 24 inches high.

- F. Resin Pegboards: Epoxy, or phenolic-composite pegboards with removable polypropylene pegs and stainless steel drip troughs with drain outlet.
- G. Engraved plastic bench labels: Comply with requirements in Section 101423.16 "Room-Identification Panel Signage" for the requirements and installations of the engraved bench labels.
- H. Add "plastic" drop tags at sink bases.
- I. Rubber sink cabinet liner, sized to fit the full width and depth of cabinet.
- J. Casters: Manufacturer's standard 3-inch swivel casters.
 - 1. Caster Brakes: Provide caster brakes to the two front cabinet casters.

2.13 CORROSIVE SAFETY CABINETS

- A. Corrosive Safety Cabinets shall be constructed similar to base cabinet with a molded polyethylene interior liner.
 - 1. Case: shall be a double-walled 18 gauge steel, provided internal backing surface for corrosion resistant inner liner. There shall be a perforated at rear for use of venting apparatus; no penetration of liner at vent opening.
 - 2. Liner: One-piece welded polypropylene, secured to case with nylon screws. The lining on the back of the doors shall be fitted so that it overlays the flange on the front of the molded cabinet liner to protect all metal areas of the cabinet. Molded liner shall incorporate a 1 inch hip lip along bottom edge to contain spills.
 - 3. Doors: Polypropylene lined with an entirely plastic door catch.
 - 4. Shelf: Acid storage cabinet shall contain one full-width manufacturer's standard shelf with 1 inch lip. Shelf support shall be integrally molded into cabinet liner.
 - 5. Labels: Provide the door with a decal signifying "ACID" storage. On acid cabinets with two doors, provide one decal signifying "ACID" on each door.
 - 6. Exhaust: Provide one threaded connection fusion welded to rear of the cabinet. Thread shall be 2 inches NPT for connection to exhaust. Provide threaded caps.

2.14 FLAMMABLE SAFETY CABINETS

- A. Flammable Safety Cabinets shall meet OSHA 29 CFR 1910.106, considered as organized storage centers for flammable and combustible liquids. Cabinets shall comply with NFPA flammable and combustible liquids Code #30 and #45, 1996. Provide grounding screw log in accordance with codes. Cabinet shall be listed and labelled to the UL1275 standard, "Standards for Flammable Liquid Storage Cabinets"
 - 1. Case: Double-walled 18 gauge steel with min. 1 ½ inch air space between panels on top, bottom, sides, back and door.

- a. Air spaces shall be filled with min. manufacturer's required blanket of high-temp fiberglass to meet NFPA and UL.
 - b. Bottom floor plan shall provide a 2 inch deep liquid tight pan to contain liquid spills and prevent leaks.
 - c. Provisions for attaching grounding wire at base of the cabinet on the outside rear panel.
2. Doors:
- a. Provide a three-point locking mechanism.
 - b. Door synchronizer shall be incorporated on double door units.
 - c. Provide with full-length stainless-steel piano hinge.
3. Shelves: Provide adjustable galvanized sheet steel shelves with four edges turned down 1 inch and additionally returned under 5/8 inch on all edges. Provide ½ inch incremental shelf adjustment.
4. Mobile: Four casters (2-locking), swivel-type. Vent holes factory plugged. Cabinets shall be ADA compliant for height, width and load capacity.
5. Labels: "FLAMMABLE-KEEP FIRE AWAY" shall be silk-screened onto door, appearing as red lettering on a bright yellow background.

2.15 WATER AND LABORATORY GAS SERVICE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Broen A/S.
 - 2. Chicago Faucets; Geberit Company.
 - 3. WaterSaver Faucet Co.
- B. Service Fittings: Provide units that comply with SEFA 7, "Recommended Practices for Fixtures." Provide fittings complete with washers, locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.
- C. Materials: Fabricated from cast or forged red brass unless otherwise indicated.
- 1. Reagent-Grade Water Service Fittings: Polypropylene, PVC, or PVDF for parts in contact with water.
- D. Finish: Chromium plated or with clear epoxy: coating complying with requirements in SEFA 7 for corrosion-resistant finishes at locations indicated on drawings.
- 1. Provide chemical-resistant powder coating in laboratory casework manufacturer's standard metallic brown, aluminum, white, or other color as approved by Design Professional.

- E. Water Valves and Faucets: Provide units complying with ASME A112.18.1, with renewable seats, designed for working pressure up to 80 psig.
 - 1. Vacuum Breakers: Provide ASSE 1035 vacuum breakers on water fittings with serrated outlets.
 - 2. Aerators: Provide aerators on water fittings where indicated on drawings.
 - 3. Self-Closing Valves: Provide self-closing valves where indicated.
- F. Ball Valves: Chrome-plated ball and PTFE seals. Handle requires no more than 5 lbf to operate. Provide units designed for working pressure up to 75 psig, with serrated outlets.
- G. Ground-Key Cocks: Tapered core and handle of one-piece forged brass, ground and lapped, and held in place under constant spring pressure. Provide units designed for working pressure up to 40 psig, with serrated outlets.
- H. Needle Valves: Provide units with renewable, self-centering, floating cones and renewable seats of stainless steel or Monel metal, with removable serrated outlets.
 - 1. Provide units designed for working pressure up to as indicated on Drawings.
- I. Hand of Fittings: Furnish right-hand fittings unless fitting designation is followed by "L."
- J. Remote-Control Valves: Provide needle valves, straight-through or angle type as indicated for fume hoods and where indicated.
- K. Handles: Provide wrist handles, forged brass handles for valves unless otherwise indicated.
 - 1. Provide lever-type handles for ball valves unless otherwise indicated. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
 - 2. Provide heat-resistant plastic handles for steam valves.
 - 3. Provide knurled, molded-plastic handles for needle valves.
- L. Service-Outlet Identification: Provide color-coded plastic discs with embossed identification, secured to each service-fitting handle to be tamper resistant. Comply with SEFA 7 for colors and embossed identification.

2.16 ELECTRICAL AND COMMUNICATION SERVICE FITTINGS

- A. Service Fittings, General: Furnish units complete with metal housings, receptacles, switches, pilot lights, data communication outlets, cover plates, accessories, and gaskets required for mounting on laboratory casework. Receptacles, terminals, switches, pilot lights, device plates, cover plate identification and accessories are specified in Division 26.
- B. Receptacles:
 - 1. Duplex Convenience Receptacles: 125 V, 20 A; NEMA WD 6, Configuration 5-20R.
 - a. Standards: Comply with NEMA WD 1, UL 498, and FS W-C-596.

2. Duplex GFCI Convenience Receptacles: 125 V, 20 A; NEMA WD 6, Configuration 5-20R; feed-through type with integral LED indicator light.
 - a. Standards: Comply with NEMA WD 1, UL 498, UL 943 Class A, and FS W-C-596.
 3. Color of Receptacles: As selected by Design Professional unless otherwise indicated or required by NFPA 70.
- C. Switches:
1. Single-Pole Switches: 120/277 V, 20 A.
 - a. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.
 2. Two-Pole Switches: 120/277 V, 20 A.
 - a. Comply with NEMA WD 1, UL 20, and FS W-S-896.
 3. Pilot-Light Switches, Single Pole: 120/277 V, 20 A, with LED-lighted handle, illuminated when switch is off.
 - a. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.
 4. Key-Operated Switches: 120/277 V, 20 A; single pole, with factory-supplied key in lieu of switch handle.
 - a. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.
 5. Color of Switches: As selected by Design Professional unless otherwise indicated or required by NFPA 70.
- D. Data Communication Outlets: Two RJ-45 jacks for terminating 100-ohm, balanced, four-pair twisted-pair cabling complying with TIA-568-C.1; complying with Category 6. Comply with UL 1863.
- E. Cover Plates: Provide satin-finish, Type 304, stainless steel cover plates with formed, beveled edges.
- F. Cover-Plate Identification: Use 1/4-inch-high letters unless otherwise indicated. For stainless steel or chrome-plated metal, stamp or etch plate and fill in letters with black enamel.
1. Provide at every cover plate.
 2. Provide the following information:
 - a. Voltage and phase for receptacles other than standard 125-V duplex, grounding type.
 - b. Indicate equipment being controlled by switches and thermal-overload switches.

- c. Indicate equipment being controlled for pilot lights when located remotely from associated equipment or switch, where function is not obvious.
 - d. Number of the breaker in panelboard that controls device.
- G. Pedestal-Type Fittings: Cast-aluminum housings with sloped single face or two faces, as indicated, with neoprene gasket under base and with concealed mounting holes in base for attaching to laboratory casework. Provide holes tapped for conduits.
- H. Line-Type Fittings: Provide with cast-metal boxes with threaded holes for mounting on rigid steel conduit. Provide cover plates same size as boxes.
- I. Recessed-Type Fittings: Provide with galvanized-steel boxes.
- J. Finishes for Service-Fitting Components: Provide housings or boxes for pedestal- and line-type fittings with manufacturer's standard baked-on, chemical-resistant enamel in color as selected by Design Professional from manufacturer's full range.
- K. Under cabinet Task-Light Fixtures: LED fixture with switch and heavy-duty cord and plug.
 - 1. Finish: Baked enamel.
 - 2. Diffusers: Virgin acrylic with high resistance to yellowing and other changes due to aging, heat, and UV radiation.
 - 3. Provide lamp
 - a. 320 Lumens
 - b. CRI: 90
 - c. Color Temperature: 2700

2.17 SEALANT

- A. Provide manufacturer's recommended epoxy adhesive around sinks, at back-splash to wall and other permanent construction and at locations indicated on the drawings.

2.18 GLASSWARE WASHER

- A. Glassware washer: Complying with AHAM DW-1
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Labconco, SteamScrubber Glassware Washer or comparable product by one of the following:
 - a. Cole-Parmer
 - b. Fisher Scientific
 - 2. Type: Undercounter.
 - 3. Dimensions: 24-inches wide x 22-inches deep.
 - 4. Performance:
 - a. Water temperature up to 199 degrees F.

- b. Steam generator that produces hot vapor.
 - c. Pump rated at 96 gal/min when operated at 115V, 60 Hz.
 - d. Synchronous drain pump rated up to 4.2 gal/min.
 - e. Purified water pump
 - f. Forced air drying into the tank programmable up to 240 minutes and from 77-176 degrees F.
 - g. Electric door latch with SpeedVent Technology.
 - h. Detergent dispenser for power or liquid detergent.
 - i. Level-sensor 6 mil rinse aid solution dispenser.
 - j. Purified water pump to bring non-pressurized purified water into the tank for up to eight pure water rinses.
5. Sound Level: Operates at or below 62 decibels.
6. Tub, front, top, sides and Door Liner: Stainless steel.
7. Rack System: Stainless steel sliding dish racks.
8. Controls:
- a. Full color touch screen display with manufacturer's controls software.
 - b. Nine factory-set programs:
 - 1) Rinse only
 - 2) Plastic
 - 3) Glass
 - 4) Glass plus
 - 5) Life Scientific
 - 6) Analytical
 - 7) Dry only
 - 8) Eco Wash
 - 9) Clean Washer
 - 10) Up to 200 user-defined programs.
 - c. Clean and specific alarm display
 - d. Calibratable setpoints such as: temperature, fill volume, detergent dispensing.
 - e. Self diagnostics
 - f. Password protection to secure washer from unauthorized changes.
 - g. User configurable delayed start (up to 12 hours)
 - h. USB data output.
9. Features:
- a. One-piece, tool-free, stainless steel, fine mesh particle drain filter.
 - b. Four leveling feet.
 - c. Aluminum -backed insulation and fiberglass thermal blanket.
 - d. Factory-installed drain hose and band camp.
 - e. Finish: 304-stainless steel exterior.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work including but not limited to the following:
 - 1. Do not install laboratory casework until all overhead work is complete including lighting, HVAC and ceiling finish.
 - 2. Do not install laboratory casework until wall finishes applied.
 - 3. Do not install laboratory casework until major overhead work is complete (including mechanical rough-in, ceiling suspension systems & lighting).
 - 4. Do not install laboratory casework until dusty operations are completed room has been cleaned and concealed utility spaces can be protected.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CABINETS

- A. Comply with installation requirements in SEFA 2. Install level, plumb, and true in line; shim as required using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:
 - 1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
 - 2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet.
 - 3. Variation of Faces of Casework from a True Plane: 1/8 inch in 10 feet.
 - 4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
 - 5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.
- B. Utility-Space Framing: Secure to floor with two fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets. Space no more than 36 inches off center.
 - 1. Provide supplemental framing at peninsula benches where no base cabinets are located at intersection with wall and bench.
- C. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions, with fasteners spaced not more than 16 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.
 - 1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches o.c. and at sides of cabinets with not less than two fasteners per side.
- D. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 16 inches o.c.

- E. Install hardware uniformly and precisely.
- F. Adjust operating hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.3 INSTALLATION OF COUNTERTOPS

- A. Comply with installation requirements in SEFA 2. Abut top and edge surfaces true in plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints where indicated on Shop Drawings.
- B. Field Jointing: Where possible, make in same manner as shop-made joints, using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Shop prepare edges for field-made joints.
 - 1. Plastic-Laminate Countertops: Secure field-made joints using concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten in accordance with manufacturer's written instructions to exert a uniform heavy pressure at joints.
- C. Fastening:
 - 1. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
 - 2. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.
 - 3. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.
- D. Provide holes and cutouts required for service fittings.
- E. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.
- F. Dress joints smooth, remove surface scratches, and clean entire surface.

3.4 INSTALLATION OF SINKS

- A. Comply with installation requirements in SEFA 2.
- B. Installation of Epoxy and Polypropylene Cup Sinks:

1. Drop-in Installation: Rout groove in countertop to receive sink rim if not shop prepared. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

3.5 INSTALLATION OF LABORATORY ACCESSORIES

- A. Install accessories in accordance with Shop Drawings, installation requirements in SEFA 2, and manufacturer's written instructions.
- B. Securely fasten adjustable shelving supports, stainless steel shelves, and pegboards to partition framing, wood blocking, or reinforcements in partitions. Fasten shelving system to support uniform live load of 100 pounds per linear foot of shelf, with shelves at 12 inches on center full height of pilasters.
- C. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated. Install standards (pilasters) as 24 inches, 30 inches or 36 inches on center so modular metal shelves can be added in the future.
- D. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.
- E. Securely fasten pegboards to partition framing, wood blocking, or reinforcements in partitions.

3.6 INSTALLATION OF SERVICE FITTINGS

- A. Comply with requirements in other Sections for installing water and laboratory gas service fittings and electrical devices.
- B. Install fittings in accordance with Shop Drawings, installation requirements in SEFA 2, and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material. Securely anchor fittings to laboratory casework unless otherwise indicated.

3.7 INSTALLATION OF GLASSWARE WASHER

- A. Install per manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely closed.
- C. Freestanding equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

- D. Engage a factory-authorized service representative to test and inspection equipment for proper installation and to train Owner's maintenance personnel to adjust, operate, and maintain appliances.

3.8 CLEANING AND PROTECTING

- A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Design Professional.
- B. Protect countertop surfaces and concealed space from dust during construction with 6-mil plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches o.c.

END OF SECTION 123553.13

SECTION 123661

SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for cantilever supports.
2. Section 224200 "Commercial Plumbing Fixtures" for non-integral sinks and plumbing fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of countertop material.

B. Shop Drawings:

1. Plans, sections, details, edge and backsplash profiles, and attachment to other work.
2. Locations and details of joints.
3. Locations, quantity, and type of supports/brackets.
4. Direction of directional pattern, if any.
5. Locations and sizes of cutouts and holes for items installed in countertop.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification:

1. Countertop material, 6 inches square.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include product data for care products used or recommended by Installer and names, addresses,

and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.
- B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.7 FIELD CONDITIONS

- A. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work..

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Quality Standard: Unless otherwise indicated, comply with ANSI/AWI 1236 for grades of simulated stone countertops indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain more stringent requirements than that of the referenced quality standard. Comply with requirements of the Contract Documents in addition to those of referenced quality standard.

2.2 SOLID SURFACE MATERIAL COUNTERTOPS

- A. Solid Surface Countertop Type SS:
 - 1. Grade: Premium.

- B. Solid Surface Material (SS): Homogeneous fabrication of mineral fillers and pigments bound together with a matrix of polymers and resins, complying with ISFA 2-01.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avonite Surfaces; a Brand of Aristech Surfaces LLC
 - b. DuPont; DuPont de Nemours, Inc.
 - c. Formica Corporation
 - d. Wilsonart LLC
 2. Colors and Patterns: As indicated on the drawings.
 3. Countertop:
 - a. Type: Standard.
 - b. Thickness:
 - 1) 3/4-inch- thick, solid surface material with front edge built up with same material.
 - c. Exposed Edge Treatment: Bevel.
 - d. Provide drip groove 1/8 inch by 1/8 inch set back 3/8 inch from front edge of countertop.
 - e. Backsplash: Detached straight.
 - 1) Height: 4 inches.
 - 2) Thickness: 1/2 inch.
 - f. End Splash: Matching backsplash.

2.3 ACCESSORIES

- A. Support Brackets:
1. Countertop:
 - a. Type: Hidden.
 - b. Material: Steel.
 - c. Color: Black powder coat.

2.4 FABRICATION

- A. Fabricate countertops in sizes and shapes required to comply with requirements indicated.
- B. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
1. Fabricate with loose backsplashes for field assembly.

C. Joints:

1. Fabricate countertops without joints.

D. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
 - b. Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch into fixture opening.
 - c. Provide 3/4-inch full bullnose edges projecting 3/8 inch into fixture opening.
2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for grommets, plumbing fittings, undercounter soap dispensers, and similar items.

2.5 INSTALLATION MATERIALS

- A. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
- B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
- C. Adhesive: Product recommended by manufacturer.
- D. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.3 INSTALLATION OF SIMULATED STONE COUNTERTOPS

- A. Grade: Install countertops to comply with specified grade.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
 - 1. Provide cutouts not finished in the shop. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- C. Countertop Installation:
 - 1. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 2. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 3. Anchor wall cleating necessary for proper setting for countertops not supported by casework.
 - 4. Install countertops level to a tolerance of 1/8 inch in 8 ft., 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
 - 5. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 6. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
 - 7. Secure countertops to subtops with adhesive according to manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 8. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - a. Install metal splines in kerfs in countertop edges at joints.
 - b. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
 - c. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

9. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
10. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
11. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls. Comply with Section 079200 "Joint Sealants."

3.4 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semi-exposed surfaces.
- C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 123661

SECTION 22 00 01 - PLUMBING GENERAL PROVISIONS

1.01 SECTION INCLUDES

- A. General Requirements.
- B. Codes, Inspections, and Permits.
- C. Layouts and Coordination.
- D. Emergency Service.
- E. Warranty.
- F. Submittals.
- G. Personnel Instruction.
- H. Inspection of Site.
- I. Construction Schedules and Phasing.

1.02 GENERAL REQUIREMENTS

- A. Furnish all labor, material and equipment and install complete all work specified and as shown on the Drawings, and any and all details essential to complete the installations, whether same are explicitly mentioned or not. Any material or labor which is neither shown on the Drawings, nor called for in the Specifications, but which is obviously necessary to complete the work and which is usually included in work of a similar character, shall be furnished and installed without additional cost.
- B. Read all Specifications and Drawings covering all branches of work so as to be fully informed regarding the work to be done as a part of this Contract and the work to be done by other contractors.
- C. The Drawings are complementary to the Specifications. Whatever is called for by one shall apply to both unless exclusively stated or shown otherwise. Any discrepancies to be clarified with the Architect during the Bidding Period.
- D. The piping and fixture layout is schematic. Exact locations shall be determined on the jobsite by structural and other conditions. This does not mean that the design of the system may be changed, it refers only to the exact locations of piping, and equipment to fit into the Building as constructed.
- E. All material and equipment shall be new, non-deteriorated, and of a quality not less than the minimum specified herein.
- F. All workmanship shall be in accordance with the best practices of the trade as determined by the representatives of the Architect. At all times, the work shall be under the directions of a competent foreman.
- G. Architect reserves the right to direct the removal and replacement of any item of work which, in his opinion, does not present an orderly, reasonably neat and workmanlike appearance, provided such items can be properly installed in such orderly way by methods usual in such work. Such removals or replacements to be provided by this Contractor when so directed by the Architect and all cost in connection therewith to be paid by this Contractor.
- H. Work found unacceptable by testing procedures, inspection agencies or the Architect shall be immediately corrected at no additional cost to the Owner. Work will be considered unacceptable when it is contrary to the plans and specifications, contract documents, governing codes or accepted standards of good quality workmanship.
- I. Insofar as this branch of work is concerned, keep premises in neat and orderly condition and promptly clean up and cart away debris and excess material from the job site.
- J. The design shown on the Drawings is based on particular types or makes of equipment (Basis of Design). If other listed types or makes of equipment (Acceptable Components) are furnished, which require modifications or changes to the Drawings or Specifications, this

Contractor shall be responsible for such changes, the cost of which shall be included in the Bid. In such case, prior to starting work, submit to Architect for approval, Drawings and Specifications showing such modifications and changes, and do not proceed with work until written approval has been obtained. Submittal of such equipment will be considered as a statement by the Contractor and manufacturer that clearances have been checked and found adequate for proper installation. See "Instructions to Bidders".

- K. The contractor shall install all equipment in accordance with the manufacturer's written installation instructions and requirements, including clearances for maintenance, necessary supports, proper torque, necessary accessories for an operable system, lubrication prior to start-up, belt tension, etc. If the manufacturer's instructions conflict with the Drawings, Specifications, or applicable building codes, the Contractor shall bring such conflicts to the attention of the Architect who shall determine which requirements apply.
- L. This contractor shall have removed and relocated any existing electrical conduit, piping, sheet metal, utilities, equipment or structure of any nature that conflicts with the installation of the work proposed under this contract, unless specifically shown to be done by another contractor. If required to remain in use, relocate items as directed by the Architect or Engineer and reinstall complete and operational with new extensions, modifications, start-ups and commissioning.
- M. Contractor shall acquaint himself with the location and size of all existing piping and utilities before any work is begun. Damage to any piping and utilities shall be a liability of the Contractor whether or not plotted on the Drawings, and all damages shall be promptly repaired or replaced to the full satisfaction of the Architect, at no additional cost to the Owner.
- N. The materials and equipment specified are established as a "standard" and the Base Bid must be submitted on this basis. See "Instructions to Bidders".
- O. All hardware, software and firmware installed under this contract, individually and in combination with each other shall function free of any fault in processing dates, and any information related to dates, (including calculating, comparing and sequencing information and/or functions which depend on dates). All dates shall include the full four-digit year.

1.03 CODES, INSPECTIONS AND PERMITS

- A. Work shall be performed and installed in compliance with the Ohio Plumbing Code requirements under the Ohio Building Code.
- B. Secure all necessary permits and licenses, file with the authorities the required Drawings and complete the work in accordance with same. Furnish the Owner all acceptance certificates.
- C. Where quantities, sizes or other requirements of the Drawings or Specifications are in excess of applicable code requirements, the Contractor shall comply with the Drawings and Specifications.
- D. Inspections will be performed by the City of Kettering.
- E. Provide all labor, material, equipment, and other necessities for all testing and inspections. Furnish all inspection reports to the Owner and Architect for recording and documentation.
- F. Energy Conservation - The project shall comply with ASHRAE Standard 90.1 - current applicable year. It is the contractor's responsibility to insure that all items of equipment submitted and/or installed meet this requirement.

1.04 LAYOUTS AND COORDINATION

- A. The Contractor shall at all times keep himself fully informed of the progress of the general construction and assist with maintaining the Project Schedule. The Contractor shall install all of his work that is concealed and built into the Building in sufficient time to ensure proper placement without delays to the work of the other trades. The Contractor shall properly attend the work during the progress of the building to prevent misalignment and damages to this work and/ or the work of other Divisions.

- B. The Contractor shall take measurements after consulting all Drawings and be responsible for same and shall layout and execute the work so as not to interfere with or delay the other Contractors on this Project.
- C. Where piping, sheet metal, plumbing, or electrical work must be installed in restricted areas, the superintendents of the various trades shall coordinate their efforts prior to installation. Should this provision be ignored, or should relocation of equipment be necessary to provide clearances for other equipment, such relocation shall be directed by the Architect and shall be done at no increase in price.
- D. It shall be the Contractor's responsibility to ensure that all equipment and apparatus, that may require maintenance from time to time, is made easily accessible. Although the location of the equipment may be as shown on the Drawings, the construction of the structure may disclose that such location of equipment does not make its position readily accessible; therefore, the Contractor shall call the attention of the Architect to this condition before advancing the construction to a point where a change in the location would cause additional cost.
- E. The exact location of apparatus, equipment, etc., shall be given from time to time as the work progresses and the contractor shall ascertain such locations from the Architect or his representative and shall lay out the work accordingly. Should the Contractor fail to ascertain such locations the work shall be changed when so ordered by the Architect. The Architect reserves the right to make minor changes in the locations of equipment and its related material up to the time of roughing-in without additional cost.

1.05 EMERGENCY SERVICE

- A. Emergency service shall be provided for the installation or equipment failures in any part of the Plumbing work and all controls, on verbal request, prior to final acceptance and during the Guarantee period.
- B. The Owner will designate three (3) individuals who will initiate the call for emergency service. The Contractor shall, in turn, designate three (3) individuals, together with current telephone numbers, who will and can perform the emergency service.
- C. Emergency services performed which are not due to defects of work or materials provided by this Contractor shall be paid by the Owner.

1.06 WARRANTY:

- A. Refer to "General Conditions" and Division 01.
- B. Warranty shall include all labor and materials to repair factory and installation defects.
- C. Provide product warranty as designated in each respective specification section.
- D. Minimum duration of any warranty shall be one year from final acceptance of work by Owner.
- E. Manufacturer's extended warranty or Protection Plan: Deliver any and all extended warranty plans or programs offered by the manufacturer, or subsidiary, which will benefit the facility Owner with no additional cost to the Owner.

1.07 SUBMITTALS

- A. Refer to Division 00, Division 01, and the General Conditions.
- B. General;
 - 1. Submittals are required from the contractor and shall show that material and equipment being furnished is compliant with the project specifications.
 - 2. The Contractor has a responsibility to submit complete sets of submittals for review and approval. Incomplete and non-compliant formatted submittals will be returned to the Contractor un-reviewed. No time extensions or cost increases will be allowed for delays caused by the return of incomplete submittals.
 - 3. Provide Manufacturer's Submittals as noted in each respective Specification Section of this Division.

4. The Contractor shall check all Manufacturer's Submittals for conformance to the Plans and Specifications and shall indicate his approval with a "Submittal Review Stamp" prior to forwarding them to the Architect. The Architect will not consider any Submittals for review which do not bear the Contractor's Stamp showing APPROVAL.
 5. Each submittal shall include the following;
 - a. A Title Sheet stating the project name, location, Architect and contractor.
 - b. A table of contents showing specific products that are included in the submittal.
 - c. Only project specific information applicable to this project.
 - d. The most current applicable edition of document.
 - e. Clean and legible pages/sheets.
 - f. Marks made by contractor or manufacturer showing exactly which items are intended to be provided. Selection marks are to be shown using bold arrow and clouds, highlighted backgrounds, or other symbol - as applicable, to show specifically which model numbers, devices, appurtenances, and illustration configurations apply.
 - g. Indication of required options and accessories that will be furnished.
 6. Architect's review of the Submittals shall not relieve the contractor from responsibility for errors or omissions in the manufacturer's information and any deviations from the Contract Drawings and Specifications.
 7. The quantities required of each individual item of equipment will not be reviewed by the Architect. The quantities needed to complete the project are the sole responsibility of the Contractor.
- C. Shop Drawings;
1. Provide Shop Drawings where required in respective Specification Sections in Division 22.
 2. Include sketches/diagrams marked, showing only those devices and options that will be furnished with each piece of equipment.
 3. Each shop drawing shall include the following information;
 - a. Manufacturer's name.
 - b. Date.
 - c. Model Number.
 - d. Weight and dimensions of equipment.
 - e. Required clearances for repairs, maintenance, air flow, and safety.
 - f. Materials used for different parts of equipment.
 - g. Show that all specified items are being furnished with equipment.
 - h. Show pipe connections; locations, size and types.
 - i. Complete electrical data including, voltage, phase, amps, minimum circuit protection ampacity, disconnect type and location, control wiring requirements along with any other specified information from respective plumbing equipment sections.
 - j. Most current dated version of drawings.
 4. Shop Drawings shall be project specific. Manufacturer's "standard" diagrams will not be accepted.
 5. Each piece of equipment submittal shall be designated to match the designations on the drawings and specifications.
- D. Product Data
1. Submittal shall be most recent issue and/ or revision available provided by the manufacturer's representative or website. Contractors "old stock" of copied submittal sheets will be rejected.
 2. Provide original documents - not copies of copies or copies of faxes.
 3. Submittals shall be published manufacturer's documentation of products and equipment being furnished.
 4. Contractor's Manufacturer of choice (brand) shall only be from the manufacturer's list in each respective specification section.
 5. Each equipment submittal shall be designated to match the designations on the drawings.
- E. Operation Maintenance Manual (O&M)

1. See Division 01 for requirements.
- F. Record Set of Contract Drawings (Record Drawings/As-Builts)
 1. Start with a clean set of Contract Drawings and mark with red pencil or pen, showing ALL deviations from the Contract Drawings during daily construction. These will become "Field Record Drawings".
 - a. Field Record Drawings shall show all Underground Piping by dimension from building walls, and depth below grade or slab in addition to all other recorded deviations.
 - b. Field Record Drawings shall be maintained at Project and kept current every day with job progress throughout Construction period.
 2. Upon completion of the project and before final approval, neatly transcribe (in red pencil only) all deviations marked in red from the Field Record Drawings on to a separate clean set of final Record Drawings. Certify to the accuracy of each print by signature and date thereon and deliver same to the Architect.
- G. Job Closing Submittals;
 1. Refer to Division 00 and Division 01 - General Requirements for closeout submittals.

1.08 PERSONEL INSTRUCTION

- A. After the O & M Manuals have been reviewed and approved, provide a minimum of four (4) hours total instruction to personnel - selected by the Owner. Instructions shall include the following:
 1. Location of items of equipment and explanation of what they do.
 2. Reference to approved Operation Maintenance Manual for record and clarity.
 3. Coordination of written and verbal instruction so that each is understood by personnel. Advise on start up, shut down, maintenance and repairs.
 4. Owner Demonstration: Prepare Certificate(s) to be signed by the personel being instructed. Certificate shall indicate System, amount of time spent under instruction, date and time instructions were given, instructor's name and affiliated company name, and confirmation the personel receiving the instructions fully understood the system operation. Place Certificate in O&M Manual.

1.09 INSPECTION OF SITE

- A. The Bidder's failure to become acquainted with the extent and nature of work required to complete any portion of the Work in conformity with the requirements of the Contract Documents shall not be a basis for additional compensation, nor relieve the contractor from performing any item of work. Bidders are encouraged to visit the site during bidding period to examine and evaluate the Site and related Project Conditions where the work will be performed.

1.10 CONSTRUCTION SCHEDULE AND PHASING

- A. Upon approval of Contract, prepare a Project Schedule, prior to starting operations, of all stages of work and sequence to be performed.
- B. Scheduling and associated approval procedures to be in accordance with General Conditions and Division 01 - General Requirements or as instructed by the Architect.
- C. The Architect in conjunction with the Owner, shall alone determine availability of spaces. No work to be performed which will hinder normal functions without expressed written permission.
- D. Scheduling of work to be coordinated with delivery schedules and work schedules prepared by other Contractors directly involved.

1.11 INTERRUPTION OF OPERATIONS AND UTILITIES

- A. Bidders are cautioned that disruption of utility services may be done only as scheduled in advance with the Architect and as approved by the Owner whose approval shall be final and binding to the Contract.
- B. In order to hold shut down times to a minimum throughout the construction process, the Contractor shall install any additional valves that will be required to isolate sections of piping to satisfy the phased progress of all work and to prevent unnecessary system outages.

- C. Interruption of water, gas, and waste water services necessary for the reconnections of this Contract work shall be scheduled as follows:
 - 1. Submit a request in writing to the Architect at least fourteen (14) days in advance of the desired outages. Request shall state the service proposed for interruption, the duration of the interruption, the areas affected and an optional date or dates for the interruption. The request shall further certify that all labor, materials and equipment necessary for completing work involved in the outage is on hand at the Site.
- D. The decision of the scheduled times of interruption by the Architect shall be final and binding on the Contract and no claim for extra compensation to the Contract may be made for overtime work necessary for interruptions outside of normal working hours.
- E. Work in corridors and traffic areas shall be scheduled and carried on so as not to impede, hamper, or be a nuisance to employees or staff. Daily clean up of debris is required.
- F. Materials and equipment required during a scheduled outage are to be in the possession of the contractor and on-site prior to starting of operations in order to ensure expeditious conclusion.
- G. The adjacent building will be occupied and in normal operation during entire period of construction. Work must be carefully coordinated and scheduled to minimize interference.

1.12 VIDEO OF SANITARY PIPING

- A. After Final Air Test, provide video recording (using current electronic version) of all horizontal underground sanitary piping to confirm sanitary drain system is open, there are no obstructions, and that there are no dips in the piping systems. Submit one copy of the video on DVD to the Owner with the O&M manuals.
- B. At 11 months following the beginning of the 1 year warranty period provide video recording (using current electronic version) of all horizontal underground sanitary piping to confirm the sanitary system has not settled creating dips in the piping. Submit one copy of the new video on DVD to the Owner and the Architect. If any settlement of the sanitary piping has occurred, the piping shall be excavated, shall be replaced with proper installation of piping. and all building finishes affected by the repairs shall be brought back to new condition.

END OF SECTION

SECTION 22 05 01 - COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe Hangers and Supports.
- B. Structural Attachments.
- C. Tests
- D. Cutting and Patching
- E. Cleaning and Painting
- F. Access Panels
- G. Removals Relocations and Salvage
- H. Equipment Logs

1.02 SUBMITTALS

- A. See Section 22 00 01 - Plumbing General Provisions, for General Plumbing Submittal requirements.
- B. Provide submittals for the following;
 - 1. Pipe hangers and supports.
 - 2. Structural attachments.
 - 3. Access panels.
 - 4. Equipment logs.

PART 2 PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

- A. This "Pipe Hangers and Supports" Section is for all General Plumbing Piping Systems in Division 22. Any additional or special hanger and support requirements will be defined in each respective section for the applicable system.
- B. Provide hangers and supports in compliance with MSS SP-58 Current Edition (2018).
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations, or address with Architect.
- C. Manufacturers
 - 1. Pipe Hangers and Supports
 - a. Unistrut: www.unistrut.com.
 - b. PHD Manufacturing: www.phd-mfg.com. (basis of design)
 - c. Anvil: www.asc-es.com.
 - d. Eaton B-line: www.eaton.com.
 - e. NPHC: www.nationalpipehanger.com
 - f. Carpenter & Patterson: www.pipehangers.com
 - g. Empire Industries: www.empireindustries.com.
- D. Conform to ASME B31.9.
- E. Un-insulated black Iron/ steel piping - Galvanized pipe hangers;
 - 1. Sizes 1/2" to 1-1/2" to be adjustable swivel ring, type based on PHD Fig. 151.
 - 2. Sizes 2" to 10" to be standard steel clevis, type based on PHD Fig. 451.
- F. Insulated Black Iron and Copper piping - pipe hangers, 2 inches and larger: Galvanized carbon steel, adjustable, clevis style.
 - 1. Sizes 1" OD to 14" OD to be standard steel clevis, sized for OD of pre-insulated pipe shield assembly, based on PHD Fig. 451.
- G. Trapeze Hangers for multiple pipes: Steel channels with welded spacers and hanger rods, based on PHD #1011 - 1012 series, perforated hot dipped galvanized (type to be determined by Contractor based on total weight of piping and fluids).

1. Copper Pipe, un-insulated, clamp to trapeze channel with inverted "U" hold-down clamp with wrap-around cushion, based on PHD #2501 - 2526 Clamps with Cushion.
 2. Steel or Copper insulated pipes with Pre-Insulated Hanger Assemblies with Galvanized Metal Shield (PHD #165 and 166 for 1/2" diameter and larger; PHD #167 and 168 for fiberglass insulation for 1-1/2" diameter and larger); clamp to trapeze channel with inverted-"U" hold-down clamp based on PHD #2001 - 2016 I.P. Pipe Clamps.
- H. Wall Support
1. Non-insulated Pipe Sizes up through 1": Split-ring clamp with 3/8" minimum hanger rod; wall flange as necessary.
 - a. Copper piping: split-ring clamp to be Epoxy-coated, similar to PHD #512. Copper plated, galvanized and black split ring clamps are prohibited on bare copper piping.
 - b. Steel piping: Split-ring clamp to be galvanized, similar to PHD #510R. Wall and ceiling flanges to match to match split-ring finish.
 2. Steel Pipe sizes 1-1/4" thru 3": Use Standard Pipe Clamp #521 to hold piping to wall.
 3. Pipe Sizes 4" thru 6": Use galvanized Heavy-duty Pipe Clamp, similar to PHD #522.
 4. Insulated Pipe: Provide galvanized Pipe Clamp with Epoxy PVC Coating to maintain pipe support and insulation vapor barrier, similar to PHD #R087100 - R412150.
- I. Vertical Support - Copper Pipe: Floor Riser Clamp
1. Riser Clamp to be Copper Epoxy coated for use on bare copper piping, see PHD #552.
 2. Riser Clamp to be Copper Epoxy with PVC coating for insulated pipe, see PHD #554.
- J. Vertical Support - non-Copper Pipe (IPS): Floor Riser Clamp
1. Riser Clamp to be Electro-Galvanized for use on bare piping, similar to PHD #551.
 2. Riser Clamp to be Electro-Galvanized with PVC coating for insulated pipe, similar to PHD #553.
- K. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support. (PHD Fig. 875 with 871.)
- L. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support. (PHD Fig. 875 with 871.)
- M. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support. (PHD Fig. 875 with 871.)
- N. Hanger Rods: Hot rolled galvanized steel, threaded both ends, threaded one end, or continuous threaded. Meet ASME B1.1, ASME B18.31.3, and ASTM A307 Grade A. Threaded nuts, couplings, and washers shall be galvanized steel, or non-rusting material.
- O. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.02 STRUCTURAL ATTACHMENT

- A. Retaining Clips: All beam clamps to be provided with metal retaining straps matching PHD #259 or #359 as applicable to the beam clamp used.
- B. Steel Beams: Provide beam clamps with eye nut for all supports from steel beams, similar to PHD #610 with #35 or PHC #620 with #35.
- C. Steel Bar Joists: Provide top beam clamp with retaining clip for all supports from steel bar joists and steel beams, similar to PHD #350 with PHD #259 or #359. "C" clamps are prohibited.
- D. Attachments to steel purlin structures shall be made with prescribed and properly sized purlin type clamps, similar to PHD #290.
- E. Concrete: Provide required type anchors approved for specific application in compliance with manufacturer's allowable weight loads, shear, and tension values. All concrete anchors shall meet ICC-ES #AC193 standards, compliant with Cracked Concrete Anchor requirements.
 1. Manufacturers:
 - a. ITW Red Head: www.itwredhead.com. (basis of design).

- b. Hilti; www.hilti.com.
 - c. Marksman Manufacturing Corp: www.marksmanmfg.com.
 - d. Simpson: www.strongtie.com.
 - e. Dewalt-Powers: www.anchors.dewalt.com.
 - f. MKT Fastening: mktfastening.com
 - g. Hanger manufacturer listed above.
- F. Friction style clips of any type are prohibited.
- G. The use of perforated steel strap supports is prohibited.
- H. The use of plastic or power-driven anchors (driven into place by use of a powder charge, compressed air, gas, or any other propellant) is prohibited.
- I. Structural attachment material shall be a non-corrosive material - galvanized, stainless steel, or other approved material, depending on the location and conditions.
- J. Additional types of structural attachments shall require a submittal for the A/E review and approval before making alternate attachments to the structure.

2.03 TESTS

- A. Furnish all labor, materials, tools, instruments and equipment required for performing tests, and to make required temporary connections. Leaks and other defects which develop under tests shall be repaired or replaced promptly, and tests to be repeated. Repairs of defective joints may only be made once. Should leaking continue, the pipe, fittings, and all other affected items shall be replaced. Repeat testing of the system - including the new joints, for final approval.
- B. Pressure and Duration of Tests: Piping Systems shall be tested with the appropriate test fluid or inert gas as applicable at 1.5 times the system pressure for a period of not less than 6 hours and shall show no drop in pressure, or per code or manufacturer's requirements - whichever is most stringent and acceptable by the AHJ.
- C. All tests are to be made before piping is concealed or covered. Completely drain the systems after hydrostatic tests are performed. Tests are to be witnessed by the AHJ, the Architect's representative, or as directed otherwise.
- D. Any elements of the systems which may be damaged by the test pressure shall be temporarily removed, isolated or bypassed. After successful completion of the tests, return the system to operating condition including reinstallation of any removed, isolated, or bypassed system elements.
- E. Sanitary drain, waste and vent piping, and all other drain systems piping, shall be tested in accordance with the governing plumbing code and shall be witnessed and approved by the assigned plumbing inspector.
- F. All pressure testing using inert gas shall be done using recording line charts to record system pressure throughout the duration of the test.

2.04 CUTTING AND PATCHING

- A. Refer to Division 01 - General Requirements and the notes on the drawings.
- B. The Plumbing Contractor shall provide the cutting and patching for the plumbing work, and is responsible for all associated costs.
- C. Use the required tools and materials to accomplish the proper cutting and patching of the building component. Trained and experienced tradesmen shall be used for the exact type of repair work and finishes.
- D. Use non-shrink cement for the patching of core-drilled holes through concrete floors.

2.05 CLEANING AND PAINTING

- A. Cleaning
1. Follow the manufacturer's written instructions for methods and products used for cleaning and maintaining plumbing items.

2. General: Clean systems, devices, fixtures, equipment, etc. before final inspection by the Architect and acceptance by the Owner. After cleaning, protect all items from dust, dirt, paint, and damage.
 3. Equipment: Clean rust appearing on factory finished equipment, prime and touch-up paint in kind. Repaint equipment to restore factory finish when directed by the Architect. Clean gauges and thermometers.
 4. Plumbing Fixtures
 - a. At all wall and floor contact with fixtures, fill joint between fixture and structure with a bead of white, GE, 50 year, silicone sealant, unless noted otherwise.
 - b. Plumbing Contractor shall cover his fixtures and equipment while any painting is being done and shall remove all paint smatterings from same upon completion of work. Factory finished equipment shall be repainted if necessary to give finished appearance.
 - c. Clean fixtures of all labels and remove stain with whiting and alcohol.
- B. Painting
1. Where not painted by the General Contractor, all exposed hangers, uninsulated pipes, stands, valves, supports, mounts, and pump bases, to be painted with (1) prime coat and one (1) finish coat by this Contractor. Prime coat shall be quick-drying, rust-inhibitive, alkyd-based primer. Finish coat shall be semi-gloss, acrylic-latex, interior enamel.
 2. This Contractor shall paint all weather exposed steel including exterior pipes and flashing: Prime coat shall be quick-drying, rust-inhibitive, alkyd-based primer. Furnish two (2) finish coats of semi-gloss, acrylic-latex, exterior enamel.
 3. Shop-primed items do not require field priming, except where shop-primer has been damaged exposing bare metal.
 4. Unless directed specifically in the plans or specifications, the finish paint color shall be determined by the Architect or Owner.

2.06 ACCESS PANELS

- A. Where access panels are indicated on the Architectural Drawings, these shall be furnished and installed by the General Contractor.
- B. This Contractor shall furnish all access panels required for proper access to the plumbing systems (equipment, piping, devices, accessories, appurtenances, etc.), whether shown on the Drawings or not.
- C. Panels shall meet the requirements of Division 8.
- D. All access panels shall be installed by the General Trades Contractor.
- E. This contractor is responsible for all costs associated with furnishing and the installation of the access panels required for this work. Access panels, as determined by the Architect, shall be appropriately sized and shall meet the structural and finish requirements, especially the structural fire rating.

2.07 REMOVALS, RELOCATIONS AND SALVAGE

- A. The Owner reserves the right to retain ownership of any items of equipment, fixtures, piping, etc. to be removed under this Contract. Such items that may be so designated in advance of removal shall be removed without damage by this Contractor and be stored on the Owner's premises where directed.
- B. All other removed materials and equipment not so designated shall become the property of this Contractor and be promptly removed from the premises.
- C. Any fixture or equipment identified to be salvaged and relocated, or reinstalled, shall be thoroughly cleaned and be placed in first class condition before reinstallation, as an obligation of the Contract, whether or not otherwise specifically called for. Refer to Drawings for identification of items to be removed by this Contractor.
- D. All existing disconnected piping that is now inactive or is rendered inactive by the new work of this Contract shall be removed, along with all associated hangers, supports, etc. Piping located

in existing (remaining) walls - need not be removed. This abandoned piping shall be cut above and below the remaining wall structure, shall be permanently capped at all openings, and made air and water-tight with permanent joints.

- E. Abandoned floor drains (in-place) shall be removed, and the drain piping serving each floor drain shall be cut below the floor and permanently capped air-tight .
- F. Abandoned drain piping and water supplies serving removed plumbing fixtures shall be plugged or capped inside the wall, which shall be replastered over by the General Contractor. No removed fixture stub-out piping shall be left exposed.
- G. Removed valves, devices, piping, etc. are prohibited for reuse, unless specifically designated for re-installation per the plans or specifications.
- H. The demolition drawings are schematic and show the intent of the demolition work. The Contractor is responsible for the removal of any and all fixtures, equipment, piping, etc. found in the building, but not shown on the drawings, which must be removed to complete the work.

2.08 EQUIPMENT LOGS

- A. For each piece of equipment requiring periodic inspection or maintenance, provide a 8-1/2" x 11" log sheet in a clear plastic envelope securely attached to the unit by a brass or aluminum chain. The log sheet shall show the date when the equipment was started and the dates when lubrication and inspection were performed and the name of the individual making the inspection. The Contractor shall maintain these charts during the construction period and shall turn them over to the Owner when the work is accepted.

PART 3 EXECUTION

3.01 PIPE HANGERS AND SUPPORTS

- A. Provide Pipe Hangers and Supports as required to provide complete piping systems. All hangers, supports, guides, anchors, and bracing shall be properly and permanently attached to the building structure.
- B. All piping and equipment shall be supported from the building structure and in no case may anything be supported from the ceiling grid system.
- C. Install in accordance with ASME B31.9.
- D. Support horizontal and vertical piping using the most stringent requirements per applicable code, manufacturer's written instructions, and the contract documents.
- E. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent structures, equipment, piping, ductwork, conduit, etc.
- F. Place hangers within 12 inches of each horizontal elbow and valve.
- G. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
- H. Provide clearance in hangers and from structures and other items for installation of insulation and access to valves and fittings. Refer to Section 22 07 19.
- I. Support vertical piping at every floor, or as required per manufacturer's written requirements. Support riser piping independently of connected horizontal piping.
- J. Where pipe support members are welded to structural building framing - scrape, brush clean, and apply one coat of zinc-rich primer to exposed material.
- K. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- L. Provide PVC coated hangers, clamps, supports, etc. for copper piping. Black and galvanized steel, cast iron, or copper plated steel materials shall not come in contact with bare copper piping.
- M. Provide vibration isolation hangers on piping adjacent to motor driven equipment.

- N. Support cast iron drainage piping at every fitting and pipe section, and in strict compliance with CISPI.
- O. Provide joint restraints on cast iron piping in strict compliance with CISPI recommendations, the AHJ, and plumbing code.

3.02 STRUCTURAL ATTACHMENTS

- A. The Contractor shall bear all responsibility for materials and workmanship as described in this section, and shall assure all hangers, supports, guides, and bracing are properly and permanently connected to the building structure. The Contractor shall meet the design requirements and install attachments to suit the project conditions. Attachments shall be appended to a rigid structural element with additional support as necessary to prevent unwarranted movement in any direction (including rotational or axial movement).
- B. All piping, equipment, etc. shall be supported from the building structure and shall not be supported from the ceiling grid system, other pipes, conduit, ductwork, or non-structural components.
- C. All anchors, clamps, and other attachments shall be sized, installed, and verified to fully provide the required support.
- D. Concrete anchors shall meet ICC-ES #AC193 standard for Cracked Concrete.
- E. Structural steel attachments shall meet MSS SP-58 standards.

3.03 TESTS

- A. Furnish all labor, materials, tools, instruments, equipment, etc. required for performing tests, and for making any required temporary connections or disconnections. Leaks and other defects which develop under the tests shall be repaired or replaced (as required). Tests will continue until the system is proven to hold the test pressure without leaks. Repairs of defective joints may only be made once, mandating replacement of the pipe, fittings, and all other affected items should leaking continue.
- B. All tests shall be made before piping is concealed or covered.
- C. Tests are to be witnessed by the A/E representative, the Authority Having Jurisdiction, and/ or as otherwise directed. Recording of the test witness and approval is the responsibility of the Contractor.
- D. Completely drain all potable water systems after hydrostatic tests are performed and verify all piping sections are void of liquids to prevent contamination.
- E. Piping systems are to be kept clean and viable for its designated use.
- F. Elements and devices which may be damaged by the test pressure shall be temporarily removed, isolated or bypassed. After successful completion of the tests, return the system to operating condition including installation of any removed, isolated, or bypassed system elements and devices. All joints in a piping system shall be tested, including components previously excluded from testing, at the maximum permissible pressure to assure no leakage.
- G. Sanitary drain, waste, and vent piping, and all other drain piping systems shall be tested in accordance with the governing plumbing code and shall be witnessed and approved by the assigned plumbing inspector. See exact piping system section for further information.
- H. Where existing fuel gas pipes are cut and capped, test new joints at caps with an approved leak detector. Test new fuel gas piping per Gas Company supplier requirements, and the Authority Having Jurisdiction. See exact piping system section.
- I. All pressure tests using an inert gas shall be done using recording line charts to record system pressure throughout the duration of the test.
- J. Pressure and Duration of Tests: Piping systems shall be tested with the required test fluid at pressures 1.5 times the working pressure and for the designated duration - or as otherwise stated in the exact piping system section. With the testing fluid supply disconnected, the piping system shall hold tight, showing no drop in pressure.

3.04 CUTTING AND PATCHING

- A. Refer to Division 01 - General Requirements, the Architectural and Structural drawings, and the Plumbing drawings for additional notes and information.
- B. All cutting and patching necessary for the plumbing work shall be performed in a professional manner, using skilled tradesmen for the exact type of work.
- C. Damage to the building shall be avoided. Use caution during cutting and removal of building components. Provide protection - such as tarps, visqueen (plastic sheets), shop vac's, water dams, etc. Provide manpower as necessary.
- D. Provide protection for other personnel during cutting and patching operations, such as barricades, warnings, and necessary manpower.
- E. Penetrations through and the cutting of structural members or supports require the written approval from the structural engineer or Architect.

3.05 CLEANING AND PAINTING

- A. Clean systems, devices, fixtures, appurtenances, and equipment before final inspection by the Architect and acceptance by the Owner. After cleaning, protect equipment and systems to minimize dirt and damage. Follow instructions in individual specification sections for additional requirements.
- B. Exposed piping - insulated and non-insulated, shall be clean and free from dust and dirt. Remove any and all extraneous items, such as paint smatterings, spackle, etc.
- C. After piping has been tested and approved, clean and prepare for painting. Exposed copper pipe to be cleaned with emery cloth and steel wool and wiped clean with acceptable solvent. Clean exposed galvanized piping with dilute acetic acid.
- D. Clean rust and other defects appearing on factory finished equipment; prime and touch-up finish paint in kind. Repaint equipment to restore factory finish as directed by the Architect.
- E. Cover fixtures and equipment while any painting is occurring, and remove all paint smatterings from same upon completion of work. Factory finished equipment shall be repainted if necessary to give finished appearance.

3.06 ACCESS PANELS

- A. This contractor is responsible for all costs associated with furnishing and the installation of the access panels required for this work. Furnish appropriately sized access panels meeting structural and finish requirements, including the fire rating.
- B. Where access panels are indicated on the Architectural Drawings, these shall be furnished and installed by the General Contractor.
- C. This Contractor shall furnish all access panels required for proper access as shown on the Drawings and as required otherwise for this work.
- D. Access panels shall be installed by the General Trades Contractor.

3.07 REMOVALS, RELOCATIONS AND SALVAGE

- A. The demolition drawings are schematic and show the intent of the demolition work. The Contractor is responsible for the removal of any and all equipment, fixture, piping, etc. found in the building, but not shown on drawings, which must be removed to complete the work.
- B. All existing disconnected piping that is now inactive, or is rendered inactive by the execution of this Contract, shall be removed, except that piping built into existing walls need not be removed, but shall be cut off in the wall behind the finish line, below the floor, and above the wall in the accessible ceiling. Openings in the remaining piping shall be capped or plugged air-tight using permanent fittings.
- C. Demolitioned items shall not be a hindrance to the progress of the project and will be removed off-site the day of removal.

- D. The abandoned drain piping below the concrete slab floor serving demolished floor drains shall be cut and permanently hard-capped with an air- and water-tight seal.
- E. Exposed stub-out piping - remnants from demolished fixtures and not reused, shall be removed and the pipe openings within the wall shall be plugged air- and water-tight with permanent fittings.

3.08 EQUIPMENT LOGS

- A. The Contractor shall maintain these charts during the construction period and shall turn them over to the Owner when the work is complete and accepted.

END OF SECTION

SECTION 22 05 04 - PLUMBING EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe Bedding.
- B. Backfill.
- C. Trench Excavation.
- D. Overdepth Excavation.
- E. Compaction.

1.02 SUBMITTALS

- A. Not Required for this section.

PART 2 PRODUCTS

2.01 PIPE BEDDING

- A. Pipe Bedding refers to the material within 3" of sides and bottom of buried pipe, and within 6" of top of pipe.
- B. Pipe bedding, except for Natural Gas piping, to be limestone #57 grey, ODOT Spec: 703, size 3/8" to 1".
- C. Pipe bedding shall be crushed stone or pea gravel passing 3/4" sieve but retained by No. 4 sieve, compacted in bottom of trench and compacted to 1/2 diameter of pipe after pipe is installed.
- D. Pipe bedding for natural gas piping shall be clean sand, free of rubble and rocks.

2.02 BACKFILL (ON TOP OF BEDDING)

- A. Backfill for underground pipe inside of Building shall be #304 Limestone, ODOT Spec: 703.16, from fine sand to 1-1/4".
- B. Backfill on top of pipe bedding for natural gas piping shall be #304 Limestone, ODOT Spec: 703.16, from fine sand to 1-1/4".
- C. Backfill for exterior utilities shall be as follows:
 - 1. Under streets, drives, walks or parking areas, wetted and compacted #304 Limestone, ODOT Spec: 703.16, from fine sand to 1-1/4".
 - 2. All other areas: Wetted and compacted bank run gravel to a depth of not less than 13" above crown of pipe. Remainder of trenches backfilled with excavated materials deposited in 6" layers, and compacted with mechanical tampers. Wet as required to obtain maximum density.

PART 3 EXECUTION

3.01 GENERAL

- A. Perform all excavating and backfilling for installation of the work of this Contract to the required depths necessary to protect piping and complete the work, as described or shown on the Drawings. Material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins.
- B. All excavated materials not required or suitable for backfill shall be removed and wasted off the Owner's property.
- C. Grading shall be done as necessary to prevent surface water from flowing into the trenches or other excavations. Any and all water accumulating therein shall be removed by pumping or by other approved method.
- D. Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled, if the pipe can be safely and properly installed and backfill can be properly tamped in such tunnel sections.

- E. Excavation shall be unclassified and shall include all materials encountered. No extra compensation will be paid for necessary excavation in rock. Refer to Structural Drawings and test boring data. Where roots of live trees are encountered in excavations they shall be carefully protected during construction.

3.02 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.03 TRENCH EXCAVATION

- A. Interior Underground Utilities: Trenches shall be of necessary width for proper laying of the pipe. Bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe at every point along its entire length, except for portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints. Bell holes and depressions for joints shall be dug after the trench bottom has been graded, and in order that the pipe rests upon the prepared pipe bed for its full length, shall be only of such length, depth and width as required for properly making the particular type of joint. All trenches shall be a minimum of 4" additional excavation at the slope required for the pipe gradient to obtain granular fill bedding depth through the length of the pipe.
- B. Exterior Utilities: Machine cut of a width not exceeding 16" greater than the barrel of pipe to be installed at a height to crown of pipe. Trenches above that level may be as wide as necessary for safety and installation of sheeting and shoring. All trenches shall be a minimum of 4" overdepth excavated at the slope required for the pipe gradient to obtain granular fill bedding depth through the length of the pipe.

3.04 OVERDEPTH EXCAVATION:

- A. Where soil encountered at the bottom of trenches is unsuitable for pipe bedding, such materials shall be removed to a depth as required for removal of such unsuitable material and be backfilled to bedding depth with hand compacted bank run gravel, or approved Low-Density Cellular Concrete (LDCC), also known as Lightweight Flowable Fill Concrete.

3.05 INSTALLATION

- A. No pipe backfill shall be performed until all piping tests are completed.
- B. Any backfill which subsequently settles shall be reopened and repaired.
- C. Pump and bail trenches, and install sheeting and shoring as necessary for the protection of the installed work. Open excavation shall be protected by lighted barricades at all times after dark.
- D. Excavation and backfill outside of the limits of finish grading and seeding work of the General Contractor shall be the sole responsibility of this Contractor. Conserve sod and topsoil. Lawns shall be left rake clean. Dead sod shall not be reinstalled. Bare areas shall be reseeded, mulched and watered as a part of this Contract. Shrubs in line of excavation shall be balled and replanted. Approved new plants shall be installed in place of dead or damaged original plants.
- E. It shall be an obligation of this Contractor to furnish required suitable backfill materials and remove all surplus excavated material from the Owner's premises. It shall also be an obligation of the Contractor to repair all damages to pavements, sidewalks, lawns, etc., and restore in kind to original condition.
- F. Install backfill to subgrade.

3.06 COMPACTION

- A. Compaction control shall be furnished by this Contractor for all fill and backfill associated with the installation of underground piping in this contract. Field compaction tests shall be performed and recorded. Written reports of field tests shall be submitted directly to the Architect/Engineer, the responsible Contractor, and the Owner.
- B. Soils shall be compacted to the following densities as determined by standard proctor tests:
 - 1. Inside structure, under non-structural slabs on grade, 98%.
 - 2. Inside structure, under special foundations, isolation pads, and footings, 100%.

3. Outside structure compaction: per site conditions.

END OF SECTION

SECTION 22 05 19 - METERS, THERMOMETERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pressure gauges and pressure gauge taps.
- B. Thermometers and thermometer wells.

1.02 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.
- C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014.
- D. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
- E. NSF 372 - Drinking Water System Components - Lead Content; 2011.
- F. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 SUBMITTALS

- A. See Section 22 00 01, for General Plumbing Submittal Requirements.
- B. Provide Product Data, Installation, Maintenance, and Job Closing submittals.
- C. Product Data: Provide Manufacturer's Product Data Submittals for Thermometers and Gauges. Include list that indicates use, operating range, total range and location for manufactured components.
- D. Project Record Documents: Record actual locations of components and instrumentation.

1.04 FIELD CONDITIONS

- A. To prevent unnecessary damage do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs. Install devices during finish phase of construction, or as necessary for completion of piping systems.
- B. Protect instrumentation from dirt and paint splatter after installation. Remove protective items before start-up and final punchout.

PART 2 PRODUCTS

2.01 GENERAL

- A. ALL PRODUCTS THAT COME IN CONTACT WITH POTABLE WATER SHALL BE NSF-61 AND ANSI-372 COMPLIANT, AND SHALL HAVE MARKINGS OR BE STAMPED WITH IDENTIFIERS INDICATING THE PRODUCT IS "LEAD-FREE" APPROVED.

2.02 MANUFACTURERS: GAUGES AND THERMOMETERS

- A. Ashcroft Inc.: www.ashcroft.com.
- B. Marsh Bellofram: www.marshbellofram.com
- C. H.O. Trerice Co.: www.trerice.com.
- D. Weiss Instruments: www.weissinstruments.com.
- E. Dwyer Instruments, Inc: www.dwyer-inst.com.
- F. Omega Engineering, Inc: www.omega.com.
- G. Miljoco Corporation: www.miljoco.com

2.03 PRESSURE GAUGES

- A. As provided as part of a Piping Specialty from Specialty Manufacturer.
- B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
 - 1. Dial Size and Cover: 4-1/2 inch diameter scale with polycarbonate window.

2. Dial Text and Markings: Black color on white background with scaled kPa and psi units.
3. Accuracy: ASME B40.100, adjustable commercial grade (D) with 5 percent of span.
4. Process Connection: Lower-back, 1/4 inch NPT male except where noted.
5. Gauge Range: Normal pressure at mid-scale of gauge.

2.04 PRESSURE GAUGE TAPPINGS

- A. 1/4" ball valve: Tee or lever handle, brass for maximum 150 psi.

2.05 STEM TYPE THERMOMETERS

- A. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
 1. Size: 9 inch scale.
 2. Window: Clear Lexan.
 3. Stem: 3/4 inch NPT brass.
 4. Accuracy: 2 percent, per ASTM E77.
 5. Calibration: Degrees F.
 6. Gauge Range: Normal temperature reading at mid-scale of thermometer.

2.06 THERMOMETER SUPPORTS

- A. Socket Well: Lead-free brass separable sockets for thermometer stems with or without extensions as required. Same manufacturer as thermometer manufacturer.

2.07 TEST PLUGS

- A. Manufacturers:
 1. Same as Gauge and Thermometer manufacturers.
 2. Pete's Plug: www.petesplug.com

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install all equipment, devices, and materials in compliance with manufacturer's written instructions. Instruments and devices shall be put in place during the finish stages of construction to prevent damage to these items. Provide protection from dirt, paint, etc.
- B. Provide pressure gauges at the following locations: where indicated on drawings, backflow preventer (inlet and outlet), pressure reducing valves (inlet and outlet), water heater (inlet and outlet), water softener (inlet and outlet), water filter (inlet and outlet), and water meter.
- C. Provide thermometers at the following locations: where indicated on drawings, at the water heater (inlet and outlet) and DHWR pipe (at water heater).
- D. Instruments and devices on insulated piping (and at other similar conditions) shall be installed to allow complete and absolute readings, and in a manner so that the instrument/ device is not impaired in any way.
- E. Prepare piping to accept water meter. Provide all necessary items for a complete and operable metering system. Coordinate with the Water Department to meet all requirements and receive final approval.
- F. Prepare piping to accept meter. Maintain all requirements for accurate readings and to allow for proper metering of the piped media.
- G. Install positive displacement meters with isolating valves on inlet and outlet, and comply with AWWA M6. Provide full line size valved bypass as shown on the drawings.
- H. Provide pressure gauges at pumps - before strainer, on suction and discharge piping of pump.
- I. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets or install at elbows with a reducing tee. Ensure sockets allow clearance from insulation.

- J. Provide instruments with scale ranges targeted so that normal system pressure and or temperature will read at mid-scale of the instrument.
- K. Install gages and thermometers in locations where they are easily read from a normal operating level from a standing position on the floor.
- L. Before placing systems into operation and before final inspection: adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- M. Locate PT (pressure-temperature) test plugs adjacent to control device sockets, and as indicated on the drawings.

3.02 SCHEDULES

- A. Pressure Gauges, Location and Scale Range:
 - 1. Pumps, inlets and outlets, 0 to 200 psi.
 - 2. Gas Regulators inlets and outlets: Outlets to be inch scale 0" to 20"water column. Inlets to be 0 PSI to 10 PSI.
 - 3. Pressure reducing valves, 0 to 200 psi.
 - 4. Backflow preventers, 0 to 200 psi.
- B. Stem Type Thermometers, Location and Scale Range:
 - 1. Domestic hot water supply and return circulation, 0 to 250 degrees F.

END OF SECTION

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Underground warning tape.
- E. Ceiling Markers.

1.02 RELATED REQUIREMENTS

- A. Section 22 10 00 - Plumbing Piping.
- B. Section 22 30 00 - Plumbing Equipment.

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems, 2020.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.
- C. ASTM F992-86 - Standard Specification for Valve Label Plates; 2011.

1.04 SUBMITTALS

- A. See Section 22 00 01, 1.06 for General Plumbing Submittal Requirements.
- B. Provide Product Data, Installation, and Job Closing submittals.
- C. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- D. Schedules:
 - 1. Submit plumbing component identification schedule listing equipment, piping, and valves.
 - 2. Detail proposed component identification data in terms of wording, symbols, letter size, and color coding to be applied to corresponding product.
 - 3. Valve Data Format: Include id-number, location, function, and model number.
- E. Product Data: Provide manufacturers catalog literature for each product required.
- F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

- A. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
- B. Brady Corporation: www.bradycorp.com.
- C. Seton Identification Products: www.seton.com.
- D. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
- E. Graphic Products: www.GraphicProducts.com
- F. Craftmark: www.craftmarkid.com.

2.02 MATCH EXISTING IDENTIFICATION PRODUCTS IN THE FACILITY AS CLOSELY AS POSSIBLE WHILE MAINTAINING THE QUALITY AND SIZING REQUIREMENTS PER ASME (ANSI) A31.1 AS A MINIMUM.

2.03 IDENTIFICATION APPLICATIONS

- A. Underground Pipe: Pipe Marking Tape.
- B. Piping: Pipe markers.
- C. Equipment: Nameplates.
- D. Valves: Valve Tags .

2.04 NAMEPLATES

- A. Description: Laminated piece with up to three lines of text.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.
 - 4. Plastic: Comply with ASTM D709.
 - 5. Text: Spell out entire name of equipment on nameplate.

2.05 VALVE TAGS

- A. To match existing and to be an extension of the existing valve tag system. If no valve tag system exists, then provide new as follows:
 - 1. Number to be 1/2" high fonts with 1/4" abbreviation of system to match drawings located below number and centered.
- B. Stamped Brass: 19 gauge 1-1/2" Round Solid Brass with smooth edges; Black Infill: 1/4" letter height, 1/2" number height; 3/16" top hole size; Maximum Temperature - Material 1200°F., Ink fill 233°F. Attach tags with permanent brass jack chain, or approved non-removable straps.
- C. Valve Tag Chart: Typewritten 12-point letter size list in anodized aluminum picture frame.

2.06 PIPE MARKERS

- A. Color, lettering, sizes, etc.: Conform to ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed. Must be fastened in place to prevent movement.
- C. Pipe markers to include minimum information - identification of fluid being conveyed and indicating flow direction arrow(s).

2.07 CEILING MARKERS

- A. Marker Description: 7/8" diameter color coded head, 0.030 thick vinyl with adhesive backing.
- B. Color code as follows:
 - 1. Plumbing Valves: Green.
 - 2. Fire Sprinkler Valve: Red.

PART 3 EXECUTION

3.01 PREPARATION

- A. Follow manufacturer's written instructions and requirements for Identification installation preparation and procedures. Locate plumbing Identification items for permanent attachment.
- B. Degrease and clean surfaces to receive identification materials with adhesive backing.

3.02 LOCATIONS AND PLACEMENT

- A. Install pipe markers (identification) in clear view and align with axis of piping from viewing positions. In open areas - piping identification shall be placed to be easily read from a normal standing position. For above ceiling or concealed locations - place piping identification to be easily read from the most likely positions through accessible locations.
- B. Pipe markers (identification) shall be placed a maximum of 20 feet increments on all straight horizontal runs, at each offset, at each floor on vertical piping, at all risers and drops, a minimum of one (1) per room, adjacent to each valve and branch tee, at each side of a structure penetration or enclosure, at each obstruction, and at connections to equipment, fixture, device, appurtenance, etc.
- C. Identify all plumbing equipment, major devices, appurtenances, etc. with nameplates. Small devices, such as in-line pumps, may be identified with tags. Equipment identification shall be positioned for viewing from normal standing height.

- D. Identify all valves in main and branch piping with tags, including valves for future use or as used for capping of a pipe section.
- E. Valves directly serving and in full view of equipment, fixtures, etc. do not need to be tagged.
- F. Place ceiling markers to locate valves and essential equipment which are above lay-in ceiling panels. Locate in corner of ceiling grid closest to equipment and able to be seen from normal standing position.

3.03 INSTALLATION

- A. Follow the manufacturer's written instructions for the installation and application of all identification items - markers, stickers, nameplates, tags, etc. Should the recommended installation process cause harm to an item or void the warranty, notify the Architect for consultation and further direction before affixing the identification item.
- B. Pipe Markers:
 - 1. Piping identification markers shall be applied to finish pipe or insulation.
 - 2. Install pipe markers completely around pipe or insulation - total circumference.
 - 3. Place piping system marker name and flow direction arrow next to each other.
 - 4. Combination Directional-Arrow with Wide-Color-Band placed on each end of pipe marker is recommended application.
- C. Use tags on piping 3/4 inch diameter and smaller.
- D. Valve Tags:
 - 1. Install valve tags with corrosion resistant chain or other approved permanent method. Position valve tag to be readily viewable and prevent tag movement from valve location. Valve tag shall not hinder or impede the operation of the valve handle.
 - 2. Identify valves in main and branch piping with valve tags. Follow facility standards for numbering each valve tag, or as directed by the Architect.
 - 3. Provide valve tag chart listing tag number, system name, abbreviated identification name, valve size, area or items served by valve, location of valve, and any additional notes.
- E. NAMEPLATES
 - 1. Install nameplates on plumbing equipment, major devices, appurtenances, etc. such as: water heaters, filters and filter assemblies, and mixing valves, and as otherwise designated.
 - 2. Install nameplates with adequate adhesive to remain affixed permanently.
 - 3. Install nameplates with corrosive-resistant mechanical fasteners (screws).
 - 4. For other types of attachment, confer with the Architect for approved methods.

3.04 SCHEDULES

- A. If the owner has no preference use the following designations:
 - 1. Domestic Cold Water: Green-DCW
 - 2. Domestic Hot Water: Green-DHW
 - 3. Natural Gas: Yellow-GAS
 - 4. Sanitary Drain: Light Green-SAN
 - 5. San Vent: Magenta-VENT

END OF SECTION

SECTION 22 05 55 - PLUMBING SLEEVES AND FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sleeves and Collars
- B. Firestopping

1.02 REFERENCES

- A. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- B. ASTM E 814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2018.
- C. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- D. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

- A. See Section 22 00 01 - Plumbing General Provisions.
- B. Provide Product Data submittals.
- C. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- D. Product Data: Provide data on product characteristics, performance ratings, and limitations.

1.04 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs which provide the specified fire ratings when tested in accordance with methods indicated, ASTM E 814, and ASTM E 119.
 - 1. Listing in the current-year classification or certification books of UL or FM will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Comply with firestopping manufacturer's written recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Stop System
 - 1. Hilti USA: www.us.hilti.com
 - 2. Tremco: www.tremcofirestop.com
 - 3. Nelson Firestop Products: www.nelsonfirestop.com
 - 4. Flame Stop, Inc.: www.flamestop.com
 - 5. 3M Fire Protection Products: www.3m.com/firestop.
 - 6. Metacaulk Firestopping Products: www.metacaulk.com
 - 7. Specified Technologies, Inc: www.stifirestop.com.

2.02 SLEEVES AND COLLARS

- A. Where pipes pass through walls, roofs, and floors, and other fire-rated structures, provide sleeves as follows:
 - 1. Sleeves for bare steel or insulated copper and steel pipe to be standard Schedule 40 or Schedule 10 galvanized steel pipe, or other non-rusting material.

2. Sleeves for bare copper pipes through walls or floors shall be Type "L" hard copper tubing (as a minimum).
3. Sleeves for bare plastic pipe shall be same as for steel pipe, while maintaining a minimum of 1/4" clearance completely around the plastic pipe to prevent damage to the plastic pipe.
4. Sleeves for insulated pipes to be 1/8" larger in radius (minimum) than insulation, shall extend 1/2" from each side of wall, and be sealed to maintain the structure's integrity.

2.03 FIRESTOPPING

- A. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. For penetrations by non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), use assembly approved Firestop Sealants/ Caulk.
 1. Firestopping: use firestopping material meeting requirements compliant with UL rated assembly for exact condition.
 2. Miscellaneous materials: Use materials meeting requirements as described in UL rated assembly for exact condition.
 3. Defective materials: Do not use out-of-date or damaged products.
 4. Firestopping Materials with Volatile Content: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
 5. Mold Resistance: Provide firestoppping materials with mold and mildew resistance rating of 0 as determined by ASTM G21.
 6. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.
 7. Fire Ratings: See Drawings for structures with required ratings.

PART 3 EXECUTION

3.01 SLEEVES AND COLLARS

- A. Set sleeves in place before new structures are built. Sleeves shall be fastened to the structure, shall be placed to center piping in the sleeve and permit the appropriate interstitial spacing for packing, caulking, and firestopping.
- B. Sleeves in existing structures shall be fastened to the structure and sealed to the structure using the same materials as the structure to maintain the structure rating. Use experienced craftsmen for the specific trade to seal around the sleeve to the structure.
- C. With Architect approval - sleeves in fire-rated walls may be sealed to the existing structure using appropriate firestopping methods and materials .
- D. Where pipes pass through walls and floors, provide sleeves as follows:
 1. In new floors, sleeves shall be set in place before floor is cast. Openings through existing floors shall be made by core-drilling. Extreme care shall be used to locate and proceed with core-drilling to prevent damage and harm to the structure or facility.
 2. Sleeves in floors shall extend fully through the floor structure and 4" (minimum) above the finish floor, shall be fastened and secured to the floor structure, shall be sealed water-tight and firestopped per the structure's rating.
 3. Space between pipe and sleeve, or pipe insulation and sleeve, shall be fire stopped.
 4. Openings through masonry walls shall be made by removing masonry units and rebuilding to match the existing construction. Length of sleeves shall be such that sleeve ends set flush with the wall surface. Pack sleeves same as sleeves through floors. Sleeves through rated walls shall be appropriately firestopped.
 5. Openings for pipe penetration at floors, walls, and ceilings shall be enclosed by one of the following:
 - a. Chrome-plated escutcheon plates on all exposed pipes, including piping in sink cabinets and piping serving fixtures.

- b. 20 gauge sheet metal collars attached to structure for larger piping as approved by Architect. Collars for firestopping shall take precedence.
 - c. Designed assemblies as described and shown in plans.
- E. All insulation shall be continuous through sleeves.
- F. Sleeves shall be sized to allow not less than 1/8" clearance all around bare pipe or pipe insulation.
- G. Openings through unrated walls shall be sound-stopped by packing with fiberglass insulation retained by collars or other suitable means.
- H. Where sleeve details are shown on the drawings the details on the drawings take precedence. The specification requirements are to be included with the drawing details as applicable.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping and caulking material, and other finishes.
- B. Remove incompatible materials which may affect bond.
- C. Install backing materials to arrest liquid material leakage and to support firestopping or caulking material in place.

3.03 FIRESTOPPING

- A. Install materials in manner described in approval agency's fire test report (UL, FM, etc.) and in accordance with manufacturer's written instructions.
- B. Maintain complete seal of openings - no gaps, cracks, spaces, or shrinkage.
- C. Do not cover over installed firestopping until inspected by authority having jurisdiction.
- D. Install labeling at each firestopping system and assembly. Attach labels permanently at both sides of structure surfaces where the labels will be visible to anyone seeking to remove the penetrating items or firestopping.
- E. Protect adjacent surfaces from damage by firestopping installation. At locations of excessive material or overfill, clean adjacent surfaces of extraneous firestopping and caulking materials.
- F. Exposed surfaces shall be maintained to match new and finished conditions.

3.04 SEALANT/ CAULKING

- A. Provide sealant or caulking at non-fire-rated structures to close off any space or opening through the sleeve assembly and piping penetration. Pack the interstitial space with mineral wool; apply sealant or caulking per the manufacturer's written instructions. Sealant and caulking shall be applicable for the type of sleeve assembly, and shall have a minimum 20-year warranty.

3.05 EXAMINATION

- A. Verify openings are ready to receive the work of this section.
- B. Confirm structures' types and match sleeve, firestopping, and sealant materials to match.

END OF SECTION

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass Fiber.
- B. Glass fiber insulation.
- C. Vapor Barrier, Mastics and Coatings.
- D. Inserts and Shields at Hangers and Supports.
- E. Jackets.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 09 91 23 - Interior Painting: Painting insulation jacket.
- C. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
- C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.
- D. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2015.
- E. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2010.
- F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).
- G. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 22 00 01 - Plumbing General Provisions.
- B. Provide Product Data, Installation, and Job Closing submittals.
- C. Product Data: Provide product submittal with description, thermal characteristics, list of materials and thickness for each service, and locations.
- D. Provide Submittals for pre-insulated piping saddles and a list of the piping systems served by the appropriate saddle selection.
- E. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.
- B. Keep Products dry and protect from damage.

1.07 FIELD CONDITIONS

- A. Maintain ambient moisture conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER INSULATION

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation: www.jm.com/#sle.
 - 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corp: www.owenscorning.com.
- B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
 - 1. K Value: ASTM C177, 0.24 at 75 degrees F.
 - 2. Maximum Service Temperature: 650 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.
- D. Insulation Fitting Covers:
 - 1. Single-piece, pre-molded, high-impact, PVC fitting covers, meeting standards LP-1035A: Type II Grade GU and Type III, LP-535E: Type II Grade GU and Type III, and the ASTM standards for PVC.
 - 2. Fiberglassbatt insulation insert matching required insulation thickness and R-value for the piping system application.
 - 3. Shall not exceed 25 Flame Spread/50 Smoke Developed rating.
 - 4. Low thermal conductivity value of 0.26 at 75°F (0.037 W/m²•°C) mean temperature.
 - 5. Does not promote growth of fungi or bacteria.

2.03 VAPOR BARRIERS, MASTICS AND COATINGS

- A. Manufacturers:
 - 1. Approved insulation manufacturer.
 - 2. Vimasco: www.vimasco.com
 - 3. Foster Products: www.fosterproducts.com
 - 4. Hy-Tech: www.hytechsales.com
- B. Vapor Barrier on insulation joints, staples and raw insulation to be per the following:
 - 1. White in color.
 - 2. Water Vapor Permeance per ASTM F 1249_Less than .08 U.S. Perms at 32 mils dry film (.05 Metric Perms) 100 degrees F, 100% RH.
 - 3. Coverage ASTM C 461, Coverage, 25 sq ft/gal at recommended minimum thickness of 1/16" wet which yields a dry film thickness of 32 mils.
 - 4. Surface Temperature range, -20°F to 180°F (-29°C to 82.2°C)
 - 5. Flame Spread Zero, Smoke Spread Zero.

2.04 INSERTS/SHIELDS AT HANGERS AND SUPPORTS

- A. Pre-Insulated Shields
 - 1. Pre-insulated pipe saddles and shields.
 - a. Saddles and shields to comply with Manufacturers Standardization Society SP-69 (type 40).
 - b. Material: Galvanized G-90
 - c. Gauge: #22 to #16.
 - d. Length: 8" to 12".
 - e. Outside Diameter: Based on nominal pipe size and insulation thickness.
 - f. Arc: 180 degrees.
 - g. Flared/ rounded edges and corners.
 - h. Center partial rib on bottom of saddle to properly secure saddle inside clevis hanger or strut system and to prevent saddle from sliding.
 - i. Service Temperature: Minus 120 degrees F to plus 500 degrees F.
 - 2. Pre insulated saddle model selection to meet piping system being served.
 - 3. Manufacturers;
 - a. Buckaroos; www.buckaroos.com.
 - b. Tru-Balance; www.tru-balancesaddles.com.
 - c. Pipe Shields Inc.; www.pipingtech.com.
 - d. VEP: www.asc-es.com
 - e. NPHC: www.nationalpipehanger.com
 - f. Carpenter & Patterson: www.pipehangers.com
 - g. Erico; www.erico.com.

2.05 JACKETING AND ACCESSORIES

- A. PVC Plastic Jacket:
 - 1. Manufacturers:
 - a. Johns Manville Corporation: www.jm.com/#sle.
 - b. Knauf Fiber Glass: www.knaufusa.com.
 - c. Owens Corning Corp: www.owenscorning.com.
 - d. CertainTeed Corporation: www.certainteed.com.
 - 2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil, 0.010 inch.
 - e. Connections: Brush on welding adhesive.
 - 3. Covering Adhesive Mastic: Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.
- C. Verify all solder flux has been removed from pipe joints per the Copper Development Association. www.copper.org.

3.02 INSTALLATION

- A. Install all pipe insulation in accordance with manufacturer's instructions, including fitting cover assemblies, attachments, joints, coatings, etc.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.

- D. Insulated pipes conveying fluids below 80 degrees F:
 - 1. Insulate entire system including pipe, fittings, valves, unions, strainers, and flexible connections.
 - 2. Use oversized insulation at all valve and clamp-on type hanger locations so that each part of the piping system has at least the minimum thickness of insulation specified.
 - 3. Insulation to have complete, unbroken vapor barrier created with vapor barrier mastic.
 - a. Use vapor barrier mastic brushed on on to seal over all staples, lap joints, longitudinal joints.
 - b. Use vapor barrier mastic brushed on on to seal over all fitting covers including circumference joints and at crotch joint.
- E. Glass Fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. Glass fiber insulated pipes conveying fluids above ambient temperature but less than 140 degrees F:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- H. Inserts and Shields:
 - 1. Application: Piping insulation 1/2" inches diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert Location: Between support shield and piping and under the finish jacket.
 - 4. Apply Tape or adhesive to each end of pipe shield to insulation to keep it from falling out.
- I. Continue insulation through walls, sleeves and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations refer to Section 22 05 55.
- J. Vapor Barrier Mastic; For pipes conveying fluids less than 80 degrees F, all Insulation joints to be Sealed with Vapor Barrier Mastic. Mastic to be brush applied over staples, entire length of longitudinal joint, each fitting cover joints including crotch and any breach in insulation's jacket.
- K. Any breach in insulation's jacket shall be repaired and sealed as soon as possible.
- L. Provide PVC Jacket on all exposed insulation located below 7'-0".

3.03 SCHEDULES

- A. Plumbing Systems (per ASHRAE Table 6.8.3 Pipe Insulation Thickness):
 - 1. Domestic Hot Water Supply and Return:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range:
 - (a) Less than 1-1/2": Thickness = 1.0 inch.
 - (b) 1-1/2" and larger: Thickness = 1.5 inch.
 - 2. Domestic Cold Water:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range:
 - (a) Less than 1-1/2": Thickness = 0.5 inch.
 - (b) 1-1/2" and larger: Thickness = 1.0 inch.
 - 3. Roof Drain Bodies:
 - a. Glass Fiber Insulation:

- 1) Pipe Size Range: All Sizes.
 - 2) Thickness: 1 inch.
4. Roof Drainage Run Horizontal at Roof Level:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: All Sizes.
 - 2) Thickness: 1.0 inch.
 - b. Insulate all horizontal piping and vertical transitions up to and including 3'-0" below and above the horizontal on the vertical.

END OF SECTION

SECTION 22 10 05 - PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Domestic water piping, above grade.
- B. Sanitary pipe buried within building.
- C. Sanitary Drain and Vent Piping Above Grade.
- D. Flanges unions and couplings.
- E. Pipe Hangers and Supports.
- F. Gate valves.
- G. Globe valves.
- H. Ball valves.
- I. Swing check valves.
- J. Spring loaded check valves.
- K. Water pressure reducing valves.
- L. Strainers
- M. Pipe hangers and supports.
- N. Balancing valves.

1.02 RELATED REQUIREMENTS

- A. Section 22 05 04 - Plumbing Excavation and Backfill.
- B. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- C. Section 22 05 55 - Plumbing Sleeves and Firestopping.
- D. Section 22 07 19 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

- A. ANSI Z223.1 - National Fuel Gas Code; 2015.
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.
- C. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2011.
- D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
- F. ASME B31.1 - Power Piping; 2014.
- G. ASME B31.2 - Fuel Gas Piping; The American Society of Mechanical Engineers; 1968.
- H. ASME B31.9 - Building Services Piping; 2014.
- I. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.
- J. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).
- K. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- L. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2015.
- M. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- N. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.

- O. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- P. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.
- Q. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2011.
- R. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.
- S. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.
- T. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes; 2012.
- U. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.
- V. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.
- W. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2015.
- X. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2013.
- Y. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.
- Z. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.
- AA. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.
- AB. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
- AC. AWWA C606 - Grooved and Shouldered Joints; 2011.
- AD. AWWA C651 - Disinfecting Water Mains; 2005.
- AE. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009.
- AF. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011.
- AG. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2013.
- AH. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.
- AI. MSS SP-67 - Butterfly Valves; 2011.
- AJ. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 2011.
- AK. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.
- AL. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
- AM. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
- AN. NSF 372 - Drinking Water System Components - Lead Content; 2011.
- AO. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe; 2013.

1.04 SUBMITTALS

- A. See Section 22 00 01, 1.06 for General Plumbing Submittal Requirements.
- B. Provide Product Data, Shop Drawings, and Job Closing submittals.

- C. Product Data: Provide manufacturer's specific data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information when applicable. Indicate all valve data and ratings.
- D. Project Record Documents: Record actual locations of valves.
- E. Installer Certification: Include copies of installer's certificate of training by the manufacturer's approved instructor with the shop drawing submittal for the system provided.

1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. NSF 61 - Annex G, 2014, Lead Free standard shall apply for potable water systems.
- C. Valves: Manufacturer's name and pressure rating marked on valve body.
- D. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Use temporary covers to protect pipe, fittings, and piping systems from entry of foreign materials during storage and installations - completing sections of the system and isolating parts of completed system.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: All piping, pipe fittings, valves, devices, accessories, appurtenances, solder and flux (if used), shall be certified per NSF 61-G (2014) and NSF 372 for lead-free content, and shall be labeled or identified accordingly.

2.02 SANITARY DRAIN PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: Hubless Cast Iron pipe and fittings shall be manufactured from gray cast iron and shall conform to ASTM A 888 and CISPI Standard 301. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute ® and listed by NSF® International.
 - 1. Manufacturers:
 - a. Charlotte; www.charlottepipe.com.
 - b. Tyler; www.tylerpipe.com.
 - c. ABI Foundry; www.abifoundry.com.
 - 2. Fittings: Hubless cast iron, All pipe and fittings to be produced by a single manufacturer.
 - 3. Joints: Hubless Couplings shall be NSF compliant and conform to CISPI Standard 310 for standard couplings and ASTM C 1540 for super duty and heavy duty couplings where indicated. Gaskets shall conform to ASTM C 564.
 - a. All 1-1/2 inch and 2 inch joints shall be made with medium duty hubless couplings with 5/16 inch hex heads that require a minimum of 80 in-lbs. of installation torque.
 - b. All 3" and larger joints shall be made with heavy duty hubless couplings with 3/8 inch hex heads that require a minimum of 80 in-lbs of installation torque. Couplings shall have Factory Mutual approval, per Standard FM 1680, and all couplings shall be marked with the FM stamp.
 - c. Manufacturers:
 - 1) Approved fitting manufacturer

- 2) Ideal; www.idealclamps.com.
- 3) Anaco; www.anaco-husky.com.
- 4) Fernco; www.fernco.com
- 5) Mission; www.missionrubber.com.
- 6) Mifab; www.mifab.com

2.03 SANITARY DRAIN AND VENT PIPING ABOVE GRADE

- A. Cast Iron Pipe: Hubless Cast Iron pipe and fittings shall be manufactured from gray cast iron and shall conform to ASTM A 888 and CISPI Standard 301. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute® and listed by NSF® International.
1. Manufacturers:
 - a. Charlotte; www.charlottepipe.com.
 - b. Tyler; www.tylerpipe.com.
 - c. ABI Foundry; www.abifoundry.com.
 2. Fittings: Hubless cast iron, All pipe and fittings to be produced by a single manufacturer.
 3. Joints: Hubless Couplings shall be NSF compliant and conform to CISPI Standard 310 for standard couplings and ASTM C 1540 for super duty and heavy duty couplings where indicated. Gaskets shall conform to ASTM C 564.
 - a. All 1-1/2 inch and 2 inch joints shall be made with medium duty hubless couplings with 5/16 inch hex heads that require a minimum of 80 in-lbs. of installation torque.
 - b. All 3" and larger joints shall be made with heavy duty hubless couplings with 3/8 inch hex heads that require a minimum of 80 in-lbs of installation torque. Couplings shall have Factory Mutual approval, per Standard FM 1680, and all couplings shall be marked with the FM stamp.
 - c. Manufacturers:
 - 1) Approved fitting manufacturer.
 - 2) Ideal; www.idealclamps.com.
 - 3) Anaco; www.anaco-husky.com.
 - 4) Fernco; www.fernco.com
 - 5) Mission; www.missionrubber.com.
 - 6) Mifab; www.mifab.com
- B. Steel Pipe: ASTM A53/A53M Schedule 40, galvanized.
1. Threaded Joints: ASME B16.4 cast iron fittings.
 2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.04 DOMESTIC WATER PIPING, ABOVE GRADE

- A. General - All Items in contact with potable water shall be 100% Lead Free per NSF 61-G (2014).
- B. Copper Tube: ASTM B 88, Type L , Hard Drawn.
1. Pipe:
 - a. All interior domestic cold water pipe 4 inch and smaller and hot water pipe of all sizes shall be Type "L" hard drawn copper tubing.
 - b. Roll grooved only in accordance to manufacturer's current listed standards and copper tube dimensions.
 - c. Filler Metal in Joints to be 100% Lead Free.
 2. Fittings:
 - a. ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze, solder type, 150 psi.
 3. Joints:
 - a. Size 2 inch and less: Soldered joints - ASTM B-32, sb5, 95-5 tin-antimony solder; ASTM B-813 water-based flux; ASTM B-28 soldering procedures.
 - b. Brazed joints, Dynaflow 6% silver brazing alloy.

- 1) T-Drill mechanically formed tees with brazed joints may be installed only when branch outlet pipe size is 1/2 the diameter or less of the main pipe size.
- c. Optional Mechanical Joints: Copper Crimp Press Fittings.
 - 1) Manufacturers
 - (a) Viega: www.viega.com.
 - (b) Nibco: www.nibco.com.
 - (c) Elkhart: www.elkhartproducts.com.
 - (d) Merit Brass: www.meritbrass.com
 - 2) Materials: Copper press fittings (1/2" to 4" hard copper tubing) shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22, conform to NSF 61 for potable water systems, and have elastomeric EPDM seals. The press fitting connections shall be compatible with seamless K and L hard copper tube made to ASTM B 88, and shall be rated for a temperature range of -20°F to +220°F and a maximum non-shock working pressure of 200 PSI. Seals shall be "Leak Detectable" system. All components shall have a 50-year warranty.
 - 3) Each copper press joint shall be made with pressing tools and jaw sets recommended and authorized by the manufacturer. All fittings, valves and tools shall be provided by the same manufacturer.
 - 4) Warranty: 50 years.
- C. PEX Piping - Crosslinked Polyethylene: Type 'A' and 'B' only. (Type 'C' is prohibited!)
 1. Manufacturing process: Engel method (PEX-A) or Silane method (PEX-B).
 2. Tubing:
 - a. Manufacturers:
 - 1) Uponor AquaPEX: www.uponor-usa.com
 - 2) Comfort Pro: www.comfortprosystems.com
 - 3) Rehau PEX: www.rehau.com
 - 4) Viega: www.viega.us
 - 5) Zurn: www.zurn.com
 - 6) Watts: www.watts.com
 - b. Material Standard: Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent third party agency
 - c. Standard grade hydrostatic design and pressure ratings from PPI
 - d. Fire-rated assembly listings in accordance with ANSI/UL 263
 - 1) UL Design No. L557 - 1-hour wood frame floor/ceiling assemblies
 - 2) UL Design No. K913 - 2-hour concrete floor/ceiling assemblies
 - 3) UL Design No. U372 - 1-hour wood stud/gypsum wallboard wall assemblies
 - 4) UL Design No. V444 - 1-hour steel stud/gypsum wallboard wall assemblies
 - e. Minimum Bend Radius (cold bending): No less than six times the outside diameter. Use a bend support as supplied by the PEX tubing manufacturer for tubing with a bend radius less than stated.
 - f. Nominal Inside Diameter: Provide tubing with nominal inside diameter, in accordance with ASTM F876 as indicated.
 - 1) 1/2 inch
 - 2) 3/4 inch
 - 3) 1 inch
 - 4) 1-1/4 inch
 - 5) 1-1/2 inch
 - 6) 2 inch
 - g. Fittings:
 - 1) Manufacturers
 - (a) Same as piping.
 - 2) Material: Fitting assembly is manufactured from material listed in paragraph 5.1 of ASTM F1960.
 - 3) Material Standard: Comply with ASTM F1960.

- 4) Type: PEX-A cold expansion fitting. Assembly consists of the appropriate ProPEX insert with a corresponding ProPEX Ring.
- h. Manifolds:
 - 1) Manufacturers;
 - (a) Same as piping.
 - 2) Material;
 - (a) Type L copper body with UNS 3600 series brass ProPEX outlet connections.
 - (b) Engineered Plastic (EP) body with ProPEX outlet connections.
 - 3) Manifold Type;
 - (a) Uponor ProPEX 1 inch Copper Manifold
 - 4) All manifolds manufactured with the appropriate-sized ProPEX fittings on the manifold supply inlets.
- i. Accessories:
 - 1) Angle stops and straight stops that are compatible with PEX tubing are supplied by the PEX tubing manufacturer.
 - 2) Bend supports designed for maintaining tight radius bends are supplied by the PEX tubing manufacturer.
 - 3) ProPEX expander tool to install the ASTM F1960 compatible fittings are supplied by the PEX tubing manufacturer.
 - 4) The tubing manufacturer provides clips and/or PEX rails for supporting tubing runs.
 - 5) All horizontal tubing hangers and riser clamps are epoxy-coated material.

2.05 FLANGES, UNIONS AND COUPLINGS

- A. Unions for Pipe Sizes 2 Inches and Under:
 1. Ferrous pipe: Class 150 malleable iron threaded unions - match pipe material.
 2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Size Over 2 Inch:
 1. Copper tube and pipe: Class 150 slip-on bronze flanges; brazed joint and preformed neoprene gaskets. Use insulating flange kit where connecting to dissimilar metals.
- C. Unions and flanges for servicing and disconnect are not required in installations using grooved joint couplings. (The couplings shall serve as disconnect points.)
- D. Couplings
 1. Couplings for Steel Pipe:
 - a. Use new Extra Heavy Pipe Couplings to couple threaded pipe together.
 - b. Pipe couplings that are furnished with threaded pipe (thread protectors) shall not be installed in piping system.
 2. Grooved and Shouldered Pipe End Couplings:
 - a. Housing: Ductile iron clamps (with copper colored alkyd enamel coating) to engage and lock, designed to permit some angular deflection, contraction, and expansion; galvanized steel bolts, nuts, and washers. Galvanized coating for galvanized pipe.
 - b. To be compatible with potable domestic copper piping.
 - c. Sealing gasket: "C" shape composition sealing gasket for system fluid.
- E. Dielectric Connections (prevent electrolosis and galvanic action):
 1. Copper to Steel piping connections; Use threaded Brass Valve and Union, with 6" long (minimum) threaded brass nipples, and copper solder end adaptors.
 2. Prohibited: Galvanized devices shall not be used on copper to steel piping connections.
 3. Equipment connections: Dielectric fittings or unions.

2.06 PIPE HANGERS AND SUPPORTS

- A. See Specification Section 22 05 01 - Common Work Results for Plumbing, for general and common pipe hangers and supports. "Non-general" hanger and support requirements for a piping system are stated in that piping system specification section.

2.07 BALL VALVES

- A. Manufacturers:
 - 1. Apollo: www.apollovalves.com (basis of design).
 - 2. Red & White: www.redwhitevalvecorp.com
 - 3. Nibco, Inc: www.nibco.com.
 - 4. Victaulic Company: www.victaulic.com
 - 5. Watts Water Technologies: www.watts.com
 - 6. Jomar: <http://www.jomarvalve.com>
- B. Natural gas - see requirements in gas valve section.
- C. Ball valves (general use) - 1/2 inch through 3 inch:
 - 1. Threaded ends, two-piece bronze body, 600 psi CWP and 150 psi SWP, chrome plated brass ball, teflon seats, bronze stem, TFE stem packing, full port. Furnish with stem extensions for insulation thickness as specified in Section 22 07 19. Based on Apollo 70LF-100 series.
 - 2. For copper pipe systems solder ends may be used - unless otherwise directed. Based on Apollo 70LF-200 series.
 - 3. Crimp-Press or press-groove type piping system valves: shall meet the same criteria as the general ball valve requirements, especially for potable water systems.

2.08 BUTTERFLY VALVES

- A. Manufacturers:
 - 1. Same as ball valve manufacturers
- B. Construction 1-1/2 inch and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.
- C. Grooved End Copper Butterfly Valves: 2-1/2 inch (65 mm) - 6 inch (150 mm), 300 psi (2068 kPa) pressure rating, with copper tubing sized grooved ends. Cast bronze body to UNS C87850. (Alloy code shall be cast or stamped into the valve body.) Elastomer encapsulated ductile iron disc, ASTM A-536, Grade 65-45-12, with integrally cast stem. Bubble tight, dead-end or bi-directional service, with memory stop for throttling, metering or balancing service. Valve may be automated with electric, pneumatic, or hydraulic operators. Victaulic Series 608N.
- D. Provide gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.09 FLOW CONTROL

- A. Manufacturers:
 - 1. Flow Design Inc.: www.flowdesign.com. (Basis of Design)
 - 2. ITT Bell & Gossett: www.bellgossett.com.
 - 3. Griswold: <http://www.griswoldcontrols.com>
 - 4. Taco, Inc: www.taco-hvac.com.
 - 5. Watts: www.watts.com
 - 6. Jomar: <http://www.jomarvalve.com>
- B. Inline automatic flow controller.
 - 1. Series 300 stainless steel wear surfaces, with nickel plated brass union nut, with flow rate at plus or minus 5%, covers over 95% of the control range.
 - 2. Certified to meet NSF 61-G (Lead Free).

2.10 SPRING LOADED CHECK VALVES

- A. Manufacturers:
 - 1. Same as ball valve.
 - 2. Watts Water Technology: www.watts.com (Basis of Design).
 - 3. Conbraco: www.conbraco.com.
 - 4. Hammond Valve: www.hammondvalve.com.
 - 5. Red & White Valve: www.redwhitevalveusa.com.
 - 6. Crane Co.: www.cranvalve.com.
 - 7. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Spring loaded check valves.
 - 1. Class 125, bronze body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

2.11 STRAINERS

- A. Manufacturers:
 - 1. Cash Acme: www.cashacme.com (Basis of Design).
 - 2. Watts: www.watts.com
 - 3. Armstrong International, Inc: www.armstronginternational.com.
 - 4. Keckley: www.keckley.com.
 - 5. Hoffman: www.hoffmanspecialty.com.
 - 6. ITT Bell & Gossett: www.bellgossett.com.
 - 7. Jomar: <http://www.jomarvalve.com>
 - 8. Other listed valve manufacturer in this section.
- B. Strainers must be compliant with NSF 61 if part of a Potable Water System.
- C. Y-pattern outlet of strainer to have full size full port ball valve with nipple and cap.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Deburr pipe and tube ends. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install all items of piping systems in accordance with manufacturer's written instructions.
- B. Sanitary DWV Piping:
 - 1. Cast iron hubless couplings shall be installed in accordance with the manufacturer's band tightening sequence and torque recommendations.
 - 2. Tighten cast iron hubless coupling bands with a properly calibrated torque limiting device per manufacturer's written instructions. Test the system hydrostatically after installation to 10 ft head (4.3 psi maximum), or other approved method.
 - 3. DWV systems shall be hydrostatically tested after installation to 10 ft. head (4.3 psi to 5.0 psi maximum). **WARNING!** Use great caution when testing with compressed air or gas on systems with PVC pipe or fittings and only per manufacturer's written instructions.
 - 4. All cutting of cast iron pipe shall be either manually or mechanically saw cut, no snap type cutting will be allowed.
 - 5. All cut ends shall be square and filed or ground smooth.
 - 6. Provide a cleanout at the base of all stacks, at each horizontal change of direction more than 45 degrees, at intervals not to exceed 50 ft, at the exit from Building, and elsewhere as required by the Ohio Plumbing Code, and as shown on the Drawings.

7. Install horizontal sanitary and drain piping 2-1/2 inch and smaller to a uniform grade of not less than 1/4 inch per linear foot. Sanitary drain piping 3 inch and larger shall be sloped no less than 1/8 inch per linear foot.
 8. Carefully coordinate the location of vents through the roof with heating and ventilating equipment so that no vents pass through the roof within 10 ft of fresh air intakes or windows. Any vents so located shall be relocated at this Contractor's expense.
 9. Pipe chases shall be laid out for maximum accessibility. Where pipe crosses chases, it shall be located at floor or more than 6 ft above floor.
 10. Provide all piping required to provide a complete sanitary drain system.
 11. Remove existing piping as indicated on the Drawings and as required to remodel the drain system.
 12. Openings in drains, fittings and equipment shall be kept plugged or capped during construction to prevent accumulating obstructions in the piping.
 13. Confirmation that drainage systems are completely free of stoppages or obstructions must be made before final payment will be released.
- C. Domestic Water Piping:
1. All piping, fittings, valves, devices, accessories, etc. shall be installed in accordance with the manufacturer's written installation instructions, and according to local codes and specification requirements.
 2. Each copper crimp press joint shall be made with pressing tools and jaw sets recommended and authorized by the manufacturer. All fittings, valves and tools shall be provided by the same manufacturer. Installers shall be trained and approved by the manufacturer. Provide copies of installer certifications with shop drawing submittals.
 3. Joint preparation: follow manufacturer's written instructions, requirements, recommendations, and specifications.
 4. Testing: per local code and AHJ, or per specification, which ever is more stringent, but do not exceed manufacturer's written restrictions or product limits.
 5. Provide DHWR balancing reports performed by a Testing, Adjusting, and Balancing company certified by a national agency, such as AABC, NEBB or TABB.
- D. Piping General
1. Install all piping in accordance with manufacturer's written instructions.
 2. Furnish and install all piping as shown on the Drawings and as required to provide complete Domestic Cold Water, Domestic Hot Water, Natural Gas, Sanitary Drains, Storm Drains, Laboratory Acid Waste, Compressed Air, and Waste Water systems.
 3. Where exposed risers occur they shall be kept as close to walls and columns as possible.
 4. Pipe shall be run concealed wherever possible.
 5. Location of pipe in interior partitions shall be carefully coordinated with the General Contractor, who will construct the partitions after the piping is in place.
 6. All piping shall be stubbed out to the exact location of the fixtures as determined by rough-in Drawings furnished by the manufacturers.
 7. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00 (099000).
 8. All piping penetrations shall be properly sealed - sleeved and packed, with an external layer of sealant. Fire-rated structures shall have UL rated fire-stopping assemblies to match structure rating.
 9. Exposed piping (bare and insulated) shall have properly sized and installed chrome plated escutcheons at each side of the structure penetration to cover the penetration opening.
 10. Provide dielectric connection separations with threaded adaptors, 6" long brass nipples and a threaded brass valve wherever joining dissimilar metal piping such as copper and steel. Use dielectric fittings at equipment and fixture connections of dissimilar metals.
 11. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
 12. Install piping to maintain headroom, conserve space, and not interfere with use of space.
 13. Group piping whenever practical at common elevations.

14. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 22 05 16.
15. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
16. Provide access where valves and fittings are not exposed.
17. Install valves with stems upright or horizontal, not inverted. See Section 22 05 23.
18. Sleeves; see section 22 05 55
19. Pipe Hangers and Supports: See section 22 05 01, Common Work Results.

3.04 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.05 DISINFECTION OF INTERIOR WATER LINES

- A. The Contractor shall employ the services of a Water Treatment Specialist employed by a recognized chemical manufacturer or by an independent laboratory to supervise disinfection of each potable water system. Specialist shall certify in writing to the Architect/Engineer, that each system is disinfected, and water samples taken from the piped water system are "potable" based on laboratory standard testing.
- B. After piping is complete and fixtures are installed, disinfect all interior hot and cold potable water piping - this includes new and existing. Risers shall be disinfected individually.
- C. With all outlets on the riser closed, fill each riser to working pressure and close valve on supply main, and hot water return valve.
- D. Open all fixtures slightly and pump a sterilizing solution into test tap at the riser as follows: 400 minimum to 1000 maximum parts per million chlorine solution made from a sanitation grade of hypochlorite 70% available chlorine. Hypochlorites may be either Pittchlor, H.T.H. or Perchlor.
- E. Each outlet, including existing outlets, shall be tested during fill to prove the presence of chlorine at that outlet. Chlorine (at least 100 parts per million) shall be present at all outlets.
- F. After system is filled, each outlet shall again be tested for presence of chlorine. Any and all supply valves shall be closed to begin the disinfection time period. Each piping system shall remain filled with disinfectant for 24 hours.
- G. After the 24-hour period, supply valves shall be opened and all outlets shall be opened wide to flush the system free of chlorine. Outlets shall be again checked and flushed until free of all chlorine. Water samples shall be taken from multiple strategic locations in each system to substantiate the piped systems are adequately proven safe.
- H. After final flushing, all aerators and screens shall be removed, cleaned and re-installed.
- I. Chlorination may be performed at same time the pressure test is placed on the system.

END OF SECTION

SECTION 22 10 06 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Drains.
- B. Cleanouts.
- C. Washing machine boxes and valves.
- D. Refrigerator valve and recessed box.
- E. Water hammer arrestors.
- F. Thermostatic mixing valves.
- G. Electronic trap-seal primers.

1.02 RELATED REQUIREMENTS

- A. Section 22 10 05 - Plumbing Piping.
- B. Section 22 30 00 - Plumbing Equipment.
- C. Section 22 40 00 - Plumbing Fixtures.

1.03 REFERENCE STANDARDS

- A. ASME A112.6.3 - Floor and Trench Drains; 2001 (R2007).
- B. ASSE 1011 - Hose Connection Vacuum Breakers; 2004.
- C. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; 2009.
- D. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.
- E. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.
- F. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
- G. NSF 372 - Drinking Water System Components - Lead Content; 2011.
- H. PDI-WH 201 - Water Hammer Arresters; 2010.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- F. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 - 2. Josam Company: www.josam.com/#sle.
 - 3. Watts Drainage: www.watts.com
 - 4. Zurn Industries, LLC: www.zurn.com.
- B. Floor Drains:
 - 1. Assembly: ASME A112.6.3.
 - 2. See listed requirements in schedule on drawings.

2.03 CLEANOUTS

- A. Assembly: ASME A112.36.2M.
- B. See listed requirements in schedule on drawings.
 - 1. Manufacturers: Same as Drains.

2.04 WASHING MACHINE BOXES AND VALVES

- A. Description: Plastic preformed rough-in box with brass long shank valves with wheel handles, socket for 2 inch waste, slip in finishing cover.

2.05 REFRIGERATOR VALVE AND RECESSED BOX

- A. Description: Plastic preformed rough-in box with brass valves with wheel handle, slip in finishing cover.

2.06 WATER HAMMER ARRESTORS

- A. Manufacturers: Same as Drains.
- B. Water Hammer Arrestors: for potable water system use.
 - 1. Assembly: ASSE 1010; ANSI A112.26.1.
 - 2. Pre-charged, piston style, permanently sealed, FDA approved, sized by demand per manufacturer's written requirements.

2.07 MIXING VALVES

- A. Thermostatic Mixing Valves:
 - 1. See Plumbing Fixture Schedule on Drawings.

2.08 PRESSURE-ACTIVATED TRAP-SEAL PRIMERS

- A. Manufacturers:
 - 1. Precision Plumbing Products: www.pppinc.net.
 - 2. Watts: www.watts.com.
 - 3. Sioux Chief: www.siouxchief.com
- B. See Plumbing Fixture Schedule on Drawings for description.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Install floor cleanouts at elevation to accommodate finished floor.
- D. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

- E. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks or washing machine outlets, flush valves, water dispensers, and as shown on the drawings.

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water Closets, Flushvalve Type.
- B. Urinals, Flushvalve Type.
- C. Lavatories.
- D. Showers.
- E. Sinks.
- F. Electric Water Coolers.
- G. Kitchen Sinks.
- H. Emergency Showers.
- I. Mop sinks.
- J. Fixtures Furnished By General Trades Contractor.

1.02 RELATED REQUIREMENTS

- A. Section 11 53 00 - Laboratory Equipment: Laboratory sinks.
- B. Section 12 36 00 - Countertops: Counters for sinks and lavatories.
- C. Section 22 10 05 - Plumbing Piping.
- D. Section 22 10 06 - Plumbing Piping Specialties.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008.
- C. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2002).
- D. ASME A112.18.1 - Plumbing Supply Fittings; 2012.
- E. ARI 1010 - Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers; Air-Conditioning and Refrigeration Institute; 2002.
- F. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011.
- G. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures; 2013.
- H. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2013.
- I. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2011.
- J. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2004.
- K. ASTM D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials; 2008.
- L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.
- N. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- O. ITS (DIR) - Directory of Listed Products; current edition.
- P. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
- Q. NSF 372 - Drinking Water System Components - Lead Content; 2011.
- R. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

- A. See Section 22 00 01 - General Plumbing Provisions.
- B. Provide Product Data, Installation, Maintenance, Job Closing, and Operation submittals.
- C. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- D. Manufacturer's Instructions: Indicate installation methods and procedures.
- E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- G. Mark each Submittal to show exactly which model number and options are intended to be provided. Include all necessary prefix and suffixes to complete the model number based on the written description in the plumbing fixture schedule.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. All piping, fixture faucets, devices, equipment, appurtenances, etc. that distribute, or come in contact with, potable water shall meet the NSF 61-G Lead-Free requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.
- C. Plumbing contractor to receive fixtures that are furnished by others on site at doorway. The Plumbing Contractor to install and pipe complete from that point on.

PART 2 PRODUCTS

2.01 GENERAL

- A. Potable Water Systems: Provide plumbing waterways, fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content (lead-free); label pipe and fittings.
- B. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

2.02 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for installation of plumbing systems.
- B. Comply with UL (DIR) requirements.
- C. Perform work in accordance with local health department regulations.
- D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

2.03 WATER CLOSETS, FLUSH VALVE TYPE

- A. See Plumbing Fixture Schedule on drawings.
- B. Wall Mounted on Carrier.
- C. China Manufacturers:
 - 1. Zurn: www.zurn.com
 - 2. Sloan: www.sloanvalve.com
 - 3. Toto: www.totousa.com
 - 4. American Standard Inc: www.americanstandard.com.
 - 5. Eljer, Inc: www.eljer.com.
 - 6. Kohler Company: www.kohler.com.

- D. Flush Valve Manufacturers:
 - 1. See Plumbing Fixture schedule on drawing.
 - 2. Fixture and valve to be a system for 1.6 GPF maximum water usage.
 - 3. American Standard: www.americanstandard-us.com
 - 4. Toto : www.totousa.com
 - 5. Geberit: www.geberit.com
 - 6. Moen Commercial: www.moen.com
 - 7. Sloan Valve Company: www.sloanvalve.com.
 - 8. Zurn Industries, Inc: www.zurn.com.
- E. Seats:
 - 1. See Plumbing Fixture Schedule on drawings for exact requirements.
 - 2. Manufacturers:
 - a. American Standard, Inc: www.americanstandard-us.com/#sle.
 - b. Bemis Manufacturing Company: www.bemismfg.com/#sle.
 - c. Church Seat Company: www.churchseats.com/#sle.
 - d. Olsonite: www.olsonite.com/#sle.
 - e. Zurn Industries, Inc: www.zurn.com/#sle.
- F. Water Closet Carriers: minimum 500 lb. rated system.
 - 1. Manufacturers:
 - a. JOSAM Company: www.josam.com/#sle.
 - b. Zurn Industries, Inc: www.zurn.com/#sle.
 - c. Jay R Smith: www.jrsmith.com.
 - d. Watts: www.watts.com
 - e. MIFAB Manufacturing, Inc.: www.mifab.com
 - f. Tyler Pipe Industries (Wade): www.wadedrains.com
 - 2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.04 URINALS, FLUSHVALVE TYPE

- A. See Plumbing Fixture Schedule on drawings for exact requirements.
- B. Wall Hung Urinal Manufacturers:
 - 1. To be same as Water Closet Manufacturer.
- C. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
- D. Urinal System: Urinal to flush using only ONE PINT of water. Fixture is required to be a system that includes the china and the valve.
 - 1. ASME A112.19.2; vitreous china, wall hung washout urinal with shields, integral trap, removable stainless steel strainer, top spud, steel supporting hanger.
 - 2. See Plumbing Fixture Schedule for more description.
- E. Carriers:
 - 1. Manufacturers:
 - a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 - b. JOSAM Company: www.josam.com/#sle.
 - c. Zurn Industries, LLC; Z1221: www.zurn.com/#sle.
 - d. Watts: www.watts.com
 - e. MIFAB Manufacturing, Inc.: www.mifab.com
 - f. Tyler Pipe Industries (Wade): www.wadedrains.com

2.05 LAVATORIES

- A. See Plumbing Fixture Schedule on drawings.
- B. Lavatory Manufacturers:
 - 1. Same as Water Closet Manufacturer.
- C. Supply Faucet Manufacturers:

1. See Plumbing Fixture Schedule on drawings.
2. American Standard, Inc: www.americanstandard-us.com/#sle.
3. Kohler Company: www.kohler.com/#sle.
4. Zurn Industries, Inc: www.zurn.com/#sle.
5. Moen Commercial: www.moen.com
6. Sloan: www.sloanvalve.com.
7. Chicago Faucets: www.chicagofaucet.com.
8. Hydrotek International: <http://www.hydrotekintl.com>
9. Symmons Industries: www.symmons.com.
10. Speakman Co.: www.speakmancompany.com.
11. T&S Brass: www.tsbrass.com.

2.06 SINKS

- A. See Plumbing Fixture Schedule on drawings.
- B. Sink Manufacturers:
 1. American Standard, Inc: www.americanstandard-us.com/#sle.
 2. Kohler Company: www.kohler.com/#sle.
 3. Amtekco: www.amtekco.com
 4. Eljer, Inc: www.eljer.com.
 5. Moen Commercial: www.moen.com
 6. Elkay Companies: www.elkay.com.
 7. Just Manufacturing: www.justmfg.com.
- C. Faucet:
 1. See Plumbing Fixture Schedule for description.
- D. Faucet Manufacturers:
 1. Same as specified for Lavatories

2.07 SHOWERS

- A. Shower base and walls by General Trades Contractor.
- B. Shower drain, valve, and head provided by Plumbing Contractor. See Plumbing Fixture Schedule for description.
- C. Drain Manufacturers: See Floor Drains.
- D. Shower Valve and Head Manufacturers:
 1. Symmons Industries: www.symmons.com.
 2. Bradley: www.bradleycorp.com
 3. Zurn: www.zurn.com
 4. American Standard Inc: www.americanstandard.com.
 5. Moen Commercial: www.moen.com
 6. Eljer: www.eljer.com.
 7. Kohler Company: www.kohlerco.com.
 8. Chicago Faucets: www.chicagofaucet.com.
 9. Speakman: www.speakmancompany.com

2.08 ELECTRIC WATER COOLERS

- A. Electric Water Cooler Manufacturers:
 1. Elkay Manufacturing Company: www.elkay.com/#sle.
 2. Haws Corporation: www.hawscorp.com/#sle.
 3. Murdock Manufacturing, Inc: www.murdockmfg.com/#sle.
 4. Oasis International: www.oasiscoolers.com/#sle.
- B. Water Cooler:
 1. See Plumbing Fixture Schedule on drawings for description and capacities.

2.09 MOP SINKS

- A. Manufacturers:
 - 1. E.L. Mustee: www.mustee.com/products.
 - 2. Fiat Products: www.fiatproducts.com.
 - 3. American Bath Group: www.americanbathgroup.com/#sle.
 - 4. Just Manufacturing Company: www.justmfg.com/#sle.
 - 5. Metcraft Industries, Inc: metcraftindustries.com/#sle.
 - 6. Zurn Industries, LLC: www.zurn.com/#sle.
- B. Mop Sink & Accessories: See Plumbing Fixture Schedule for description.

2.10 KITCHEN SINKS

- A. Manufacturers:
 - 1. Amtekco: www.amtekco.com
 - 2. Elkay: www.elkayusa.com
 - 3. Just: www.justmfg.com
 - 4. Advance Tabco: www.advancetabco.com
- B. See Plumbing Fixture Schedule for complete description.
- C. Metal Thickness shall be 16 gauge 300 series stainless steel.

2.11 EMERGENCY SHOWER AND EYE/FACE WASHES

- A. Manufacturers:
 - 1. Bradley Corp.: www.bradleycorp.com.
 - 2. Haws Corporation: www.hawesco.com/#sle.
 - 3. Guardian Equipment Co.: www.gesafety.com.
- B. See Plumbing Fixture Schedule for description.

2.12 FIXTURES FURNISHED BY GENERAL TRADES CONTRACTOR

- A. Laboratory Fixtures.
 - 1. Provide all items necessary for a complete and operable installation.
 - 2. Coordinate exact plumbing requirements with General Trades Contractor prior to rough-in.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that proper electric power is available and of the correct characteristics for fixtures that require it.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture installation instructions for particular fixtures.
- B. Rough-in fixture supports including carriers and proper backing inside walls.

3.03 INSTALLATION

- A. Install isolation valves and soft-seated spring-loaded check valves on the DCW and DHW supply lines serving Mop, Janitor, or Custodial sink faucet. Location of these valves to be accessible for maintenance.
- B. Provide chrome plated rigid or flexible SS supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level, square and plumb.

- D. Water closet and urinal fixture drain seals may be Fernco Wax Free Seals: ASTM A1045 compliant, sized correctly for drain piping connection, per manufacturer's written instructions, and approved by plumbing code and AHJ.
- E. Install Grid strainers in lavatories with strainer perforations with engraved manufacturer's insignia square to wall.
- F. Install and secure fixtures in place with wall carriers, finish nuts and bolts.
- G. Seal fixtures to wall and floor surfaces with White GE 50 year, silicone sealant, color to match fixture.
- H. Seal sink rims at all counter-top sinks water-tight per manufacturer's written instructions.
- I. The Plumbing Contractor shall provide templates for countertop sink cutouts.
- J. Fixtures mounted at standard heights recommended by the fixture manufacturer except as noted on the Architectural Drawings and per ADA where required.
- K. Fixtures and other plumbing items furnished by others shall be installed and final plumbing connections made by the plumbing contractor per the manufacturer's written instructions, including restrictions for detrimental chemicals and materials to the product.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
- B. Provide all necessary rough-ins, adapters and fittings to make all final connections to fixtures and fittings provided by others for complete and operable equipment.
- C. The point of connection on sinks will be to the tail piece which will be furnished with the sinks.

3.05 ADJUSTING

- A. Adjust Lavatory Mixing valves for 109 degrees F maximum outlet temperature.

3.06 CLEANING

- A. Clean plumbing fixtures and equipment to brand new condition prior to punch list inspection.

3.07 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.
- D. Clean all paper labels from fixtures, flush supplies and adjust valves, and leave clean immediately prior to final inspection.
- E. After final flushing, all aerators on plumbing brass and shower heads shall be removed, cleaned and re-installed. All aerators and shower heads to have a smooth, full, uniform discharge flow with no evidence of any restrictions.

SECTION 22 67 05 - LABORATORY PURE WATER PIPING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Provide all materials, labor, etc. for a fully operational and functioning system as described in this section, on the drawings, and the contract documents.

1.02 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for the following piping systems:
 - 1. Deionized Water.

1.03 RELATED REQUIREMENTS

- A. Section 22 0553 - Identification for Plumbing Piping and Equipment.
- B. Section 22 10 06 - Plumbing Piping Specialties

1.04 REFERENCE STANDARDS

- A. ANSI/NSF Standard 14 Plastics Piping System Components and Related Materials.
- B. American National Standards Institute (ANSI)/Underwriters Laboratories, Inc. (UL).
- C. ANSI/UL 263 Standard for Safety for Fire Tests of Building Construction and Materials.
- D. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2004 - use most current version (ANSI/ASME B31.9).
- E. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.
- G. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- H. ASTM F 708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2004) - use most current version.
- I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2002 - use current version.
- J. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003 - use current version.
- K. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003 - use current version.

1.05 SUBMITTALS

- A. Provide Product Data, Installation, Maintenance, Job Closing, and Operation submittals.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Project Record Documents: Record actual locations of valves, and deviations from drawings.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with []tandards of Ohio.
 - 1. Maintain one copy on project site.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Identify pipe with marking including size, ASTM material classification, ASTM specification, water pressure rating.
- D. Installers shall be qualified, certified, and properly trained to install these piping systems according to industry standards, and to the requirements of the AHJ, manufacturer, these specifications, and any other regulatory authority.

1.07 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with the Plumbing Code of Ohio.
- B. Conform to applicable code for installation of backflow prevention devices.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary end caps and closures on piping, valves, and fittings. Maintain in place until installation. Cap all open piping ends after placement and installation to maintain clean interior.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
- D. Comply with all manufacturers material storage and handling requirements to fulfill maximum warranty time span requirements.

PART 2 PRODUCTS

2.01 PIPING FOR DEIONIZED WATER SYSTEMS

- A. Manufacturers:
 - 1. Orion Whiteline (a Watts brand): www.watts.com.
 - 2. Simtech Process Systems (Kynar): www.simtechusa.com/products..
 - 3. Harrington Process Solutions: www.store.hipco.com.
 - 4. Other approved manufacturer.

2.02 PIPING FOR TYPE 2 PURE WATER DEIONIZED WATER SYSTEMS

- A. Pipe: Orion Whiteline Pipe- Pipe shall be manufactured to Schedule 80 iron pipe dimensions from virgin unpigmented Type I Homopolymer Polypropylene, meeting ASTM D4101, using no anti-oxidants or pigments.
- B. Pipe shall be furnished in 10' lengths pregrooved. Pipe shall meet the dimensional tolerances of ASTM D2447. All pipe shall be capped and bagged.
- C. Fittings: Riontite® - Fittings shall be manufactured to Schedule 80 wall thickness from virgin unpigmented Type I Homopolymer Polypropylene, meeting ASTM D4101, using no plasticizers or pigments.
- D. Fittings shall be complete with elastomeric face seal, PVDF snap ring and nut. Each fitting shall be individually bagged. Fittings shall test to 150 psi @ 73°F
- E. Ball Valves: Orion Whiteline Riontite® Polypropylene- Ball valve shall be manufactured from virgin unpigmented Type I Homopolymer Polypropylene to be fully compatible with the Orion high purity Whiteline system. All valves shall test to 150 psi at 73°F. Each ball valve shall be individually bagged.
- F. Ball Check Valves: Orion Whiteline Riontite™ Polypropylene- Ball check valve shall be manufactured from virgin unpigmented Type I Homopolymer Polypropylene to be fully compatible with the Orion high purity Whiteline system. All valves shall test to 150 psi @ 73°F. Each valve shall be individually bagged.
- G. Needle Valves: Orion Whiteline Riontite™ Polypropylene- Needle valve shall be manufactured from virgin unpigmented Type I Homopolymer Polypropylene to be fully compatible with the Orion high purity Whiteline system. All valves shall test to 150 psi @ 73°F.
- H. Diaphragm Valves: Orion Whiteline Riontite™ Polypropylene- Diaphragm valve shall be manufactured from a virgin unpigmented Homopolymer, meeting ASTM D4101, to be fully compatible with the Orion high purity Whiteline system. All diaphragm valves will test to 150 psi @ 73°F. All valves will be individually bagged.

2.03 FLANGES, UNIONS, AND COUPLINGS

- A. Flanges Unions and Couplings to be compatible with type 2 high Purity Water Piping System
- B. Flanges, Unions, and Couplings to be stainless steel and compatible with piping and fitting system used. Bolts, nuts, and other system accessories shall be stainless steel.
- C. Gaskets and seals shall be compatible with system fluid.

2.04 PIPE HANGERS AND SUPPORTS

- A. Type 2 Pure Water Piping:
 - 1. Support pure water piping system in strict compliance with Manufacturers Recommendations.

2.05 ALL VALVES

- A. Manufacturers:
 - 1. Valve Manufacturer to be the same type as the fittings, or otherwise approved by Owner.
 - a. Valves shall be same as the piping fittings - materials, components, etc. and compatible with the system fluid.
 - b. Alternate: Stainless steel ball valves compatible with system fluid.

2.06 RELIEF VALVES

- A. Same manufacturer and type as for Valves (above).

2.07 STRAINERS

- A. Manufacturers:
 - 1. Same as PVDF piping.
- B. Size 2 inch and Under:
 - 1. PVDF body, stainless steel #35 mesh, socket ends, rated for 150 psi at 72 degrees F.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify pipe and fittings are clean and free from defects before installation.

3.02 PREPARATION

- A. Prepare and install Piping system in strict compliance with Manufacturer's written instructions.

3.03 INSTALLATION

- A. Piping General
 - 1. Furnish and install all piping as shown on the Drawings and as required to provide the complete Deionized Water System.
 - 2. Install all piping in accordance with these specifications and manufacturer's instructions.
 - 3. Provide non-conducting dielectric connections wherever joining dissimilar metals.
 - 4. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
 - 5. Install shut off valves on all branches from piping mains. All valved water pipe branches to be fitted with drain valves.
 - 6. Where exposed risers occur they shall be kept as close to walls and columns as possible.
 - 7. Pipe shall be run concealed wherever possible.
 - 8. Location of pipe in interior partitions shall be carefully coordinated with the General Contractor, who will construct the partitions after the piping is in place.
 - 9. All piping shall be stubbed out to the exact location of the fixtures as determined by rough-in drawings furnished by equipment manufacturers.
 - 10. Sleeve through beams only at locations shown or as approved by the Structural Engineer.
 - 11. Install piping to maintain headroom, conserve space, and not interfere with use of space.
 - 12. Group piping whenever practical at common elevations.

13. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
 14. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with General Trades Contractor.
 15. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
 16. Install valves with stems upright or horizontal, not inverted.
 17. Sleeve pipes passing through partitions, walls and floors: firestop per UL rated assemblies.
 18. Inserts:
 - a. Provide inserts for placement in concrete formwork.
 - b. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams; anchors shall meet ICC-ES #AC 193 (cracked concrete).
 - c. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- B. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
 2. Support horizontal piping as scheduled.
 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 4. Place hangers within 12 inches of each horizontal elbow.
 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 8. Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
 - a. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
 - b. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
 - c. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
 - d. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
 - e. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
 - f. Other Types: As required.

3.04 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Provide spring loaded check valves on discharge of water pumps.
- D. Provide flow controls in water circulating systems where indicated.
- E. Exposed piping shall have properly sized and installed chrome plated escutcheons at each side of the structure penetration to cover the opening.

3.05 ERECTION TOLERANCES

- A. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 TESTING

- A. Provide testing of the piping system to prove tightness of pipe, fittings, and all joints. Test shall be recorded and witnessed by AHJ and/or owner representative with signature and date.
- B. Testing procedure shall follow manufacturer's written instructions, meet AHJ's requirements, or as instructed in this section as a minimum.
- C. Pretest piping system with clean, dry nitrogen gas to 50 PSI for 30 minutes with no loss of pressure. Upon successful Pretest, the piping system shall be pressurized with dry, clean nitrogen gas to 150 PSI (as manufacturer's requirements allow); leak-test every joint. Leaks

shall be remedied by repairing or replacing the fitting. Retesting will be conducted until all leaks are eliminated and the system holds tight.

3.07 STERILIZATION OF DEIONIZED WATER LINES

- A. The Contractor shall employ the services of a Water Treatment Specialist employed by a recognized chemical manufacturer or by an independent laboratory to supervise sterilization of the systems. Specialist shall certify in writing to the Architect that the systems are sterilized, and water taken from the system is potable.
- B. After piping is complete and fixtures have been installed, sterilize all deionized water piping.
- C. With all outlets on the riser closed, fill each riser to working pressure and close valve on supply main, and recirculating return valve.
- D. Open all outlets slightly and pump a sterilizing solution into test tap at the riser as follows: 400 minimum to 1000 maximum parts per million chlorine solution made from a sanitation grade of hypochlorite 70% available chlorine. Hypochlorites may be either Pittchlor, H.T.H. or Perchlor.
- E. Each outlet, including existing outlets, shall be tested during fill to prove the presence of chlorine at that outlet. Chlorine shall be present at all outlets.
- F. Water piping system shall remain filled for a period of 24 hours and each outlet shall be again tested and shall have at least 100 parts per million of chlorine remaining.
- G. All outlets shall be open wide and the main supply valve opened, flushing system free of chlorine. Outlets shall be again checked and flushed until free of chlorine.
- H. Chlorination may be performed at same time the pressure test is placed on the system.
- I. Provide piping system sterilization report by agency performing piping cleaning service. Piping system shall meet compliance for cleanliness as required, and approved by owner.

3.08 SERVICE CONNECTIONS

- A. Provide connections as required per contract documents, including outage requirements.

3.09 SCHEDULES

- A. Pipe Hanger Spacing:
 - 1. The Plumbing Code of Ohio and the Manufacturer's recommendations shall govern the required minimum Hanger Spacing.

END OF SECTION

SECTION 23 05 00 - HVAC GENERAL PROVISIONS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

- A. Furnish all labor, material and equipment and install complete all work hereinafter specified and as shown on the Drawings, and any and all details essential to complete the installations, whether same are specifically mentioned or not. Any material or labor which is neither shown on the Drawings, nor called for in the Specifications, but which is obviously necessary to complete the work and which is usually included in work of a similar character, shall be furnished and installed without additional cost.
- B. Read all Specifications and Drawings covering all branches of work so as to be fully informed regarding the work to be done as a part of this Contract and the work to be done by other contractors.
- C. The Drawings are complementary to the Specifications. Whatever is called for by one shall apply to both unless specifically stated or shown otherwise. Any discrepancies to be clarified with the Architect during the Bidding Period.
- D. The piping and duct layout is schematic. Exact locations shall be determined on the job by structural and other conditions. This does not mean that the design of the system may be changed, it refers only to the exact locations of piping, ductwork and equipment to fit into the Building as constructed.
- E. All material and equipment shall be new, undeteriorated, and of a quality not less than the minimum specified herein.
- F. All workmanship shall be in accordance with the best practices of the trade as determined by the representatives of the Architect. At all times, the work shall be under the directions of a competent foreman.
- G. Architect reserves the right to direct the removal and replacement of any item of work which, in its opinion, does not present an orderly, reasonably neat and workmanlike appearance, provided such items can be properly installed in such orderly way by methods usual in such work. Such removals or replacements to be done by this Contractor when so directed by the Architect and all cost in connection therewith to be paid by this Contractor.
- H. Work found unacceptable by testing procedures, inspection agencies or the Architect shall be immediately corrected at no additional cost to the Owner. Work will be considered unacceptable when it is contrary to the Specifications, governing codes or accepted standards of good workmanship.
- I. Insofar as this branch of work is concerned, keep premises in neat and orderly condition and promptly clean up and cart away debris and excess material from the job site.
- J. The design shown on the Drawings is based on particular types or makes of equipment (Basis of Design). If other listed types or makes of equipment (Acceptable Components) are furnished, which require modifications or changes in the Drawings or Specifications, this Contractor shall be responsible for such changes, the cost of which shall be included in the Bid. In such case, prior to starting work, submit to Architect for approval, Drawings and Specifications showing such modifications and changes, and do not proceed with work until approval has been obtained. Submittal of such equipment will be considered as a statement by the Contractor and manufacturer that clearances have been checked and found adequate. See "Instructions to Bidders".
- K. The contractor shall install all equipment in accordance with the manufacturer's installation instructions, including clearances for maintenance, necessary supports, proper torque, necessary accessories for an operable system, lubrication prior to start-up, belt tension, etc. If manufacturer's instructions conflict with the Drawings, Specifications, or applicable building codes, the Contractor shall bring such conflicts to the attention of the Architect who shall determine which requirements apply.

- L. This contractor shall remove and relocate any existing electrical conduit, piping, sheet metal, utilities, equipment or structure of any nature that conflicts with the installation of the work proposed under this contract, unless specifically shown to be done by another contractor. If required to remain in use, relocate items as directed by the Architect and reinstall complete and operational with new extensions, modification, start-up and check-out as needed.
- M. Contractor shall acquaint himself with the location and size of all existing piping and utilities before any work is begun. Damage to any piping and utilities shall be a liability of the Contractor whether or not plotted on the Drawings, and all damages shall be promptly repaired or replaced to the full satisfaction of the Architect.
- N. The materials and equipment specified are set up as a "standard" and the Base Bid must be submitted on this basis. See "Instructions to Bidders".
- O. In order to hold shut down times to a minimum, the Contractor shall install any additional valves that will be required to isolate sections of piping to satisfy the phased progress of all work.
- P. All hardware, software and firmware installed under this contract, individually and in combination with each other shall function free of any fault in processing dates, and any information related to dates, (including calculating, comparing and sequencing information and/or functions which depend on dates). All dates shall include the full four-digit year.

1.02 CODES, INSPECTIONS AND PERMITS

- A. Work is to be performed and installed in compliance with the 2024 Ohio Mechanical Code and the 2024 Ohio Building Code.
- B. Secure all necessary permits, licenses, file with the authorities required Drawings and complete the work in accordance with same. Furnish the Owner with all acceptance certificates.
- C. Where quantities, sizes or other requirements of the Drawings or Specifications are in excess of applicable code requirements, the Contractor shall comply with the Drawings or Specifications.
- D. Energy Conservation - The project shall comply with ASHRAE Standard 90.1 - 2010. It is the contractor's responsibility to insure that all items of equipment submitted and/or installed meet this requirement.

1.03 LAYOUTS AND COORDINATION

- A. The Contractor shall at all times keep himself fully informed of the progress of the general construction, and shall install all of his work that is concealed and built into the Building in sufficient time to ensure proper location without delays to the work of the other trades. Properly attend the work during progress of the building to prevent misalignments and damages to this work or the work of other Divisions.
- B. The Contractor shall take measurements after consulting all Drawings and be responsible for same and shall layout and execute the work so as not to interfere with or delay the other Contractors on this Project.
- C. Where piping, sheet metal, plumbing, or electrical equipment must be installed in restricted areas, the superintendents of the various trades shall coordinate their efforts prior to installation. Should this provision be ignored, or should relocation of equipment be necessary to provide clearances for other equipment, such relocation shall be directed by the Architect and shall be done at no change in price.
- D. It shall be the Contractor's responsibility to see that all equipment and other apparatus that may require maintenance from time to time is made easily accessible. Although the location of the equipment may be as shown on the Drawings, the construction of the structure may disclose that such location of equipment does not make its position readily accessible; therefore, the Contractor shall call the attention of the Architect to the condition before advancing the construction to a point where a change in the location would reflect additional cost.
- E. The Architect reserves the right to make minor changes in the locations of equipment and its related material up to the time of roughing-in without additional cost.

1.04 EMERGENCY SERVICE

- A. Emergency service shall be provided for installation or equipment failures in any part of the HVAC work and all controls, on verbal demand, prior to final acceptance and during the Guarantee period.
- B. The Owner will designate three (3) individuals who will initiate the call for emergency service. The Contractor shall, in turn, designate three (3) individuals, together with current telephone numbers, who will and can perform the emergency service.
- C. Emergency services performed which are not due to defects of work or materials supplied by this Contractor will be paid by the Owner.

1.05 WARRANTY

- A. Refer to "General Conditions" and Division 01.

1.06 SHOP DRAWINGS AND SUBMITTALS

- A. Refer to Division 01 and the General Conditions.
- B. The Contractor has a responsibility to submit complete shop drawings and other required submittals. Incomplete submittals will be returned to the Contractor unreviewed. No time extensions or cost increases will be allowed for delays caused by return of incomplete submittals.
- C. Submit shop drawings and manufacturers submittals as noted in each respective Specification Section of this Division.
- D. The Contractor shall check all manufacturer's Drawings for conformance to the Plans and Specifications and shall indicate his approval of the Drawings before forwarding them to the Architect. The Architect will not consider any manufacturer's Drawings for review which do not bear the Contractor's stamp of approval.
- E. The Architect's review of manufacturer's Drawings or schedules shall not relieve the Contractor from responsibility for errors or omissions in manufacturer's Drawings and deviations from the Contract Drawings or Specifications.
- F. Each submittal to be complete with a title sheet stating the project name and location, Architect, Contractor and a table of contents.
- G. Shop Drawings shall include diagrams showing only those devices and options furnished with each piece of equipment. Manufacturer's "standard" diagrams will not be accepted.
- H. Furnish performance curves and/or charts for all pumps and fans.
- I. The quantities required of each individual item of equipment will not be reviewed by the Architect. The quantities needed to complete the project are the sole responsibility of the Contractor.

1.07 OPERATION - MAINTENANCE MANUAL, PERSONNEL INSTRUCTION AND RECORD DRAWINGS

- A. Operation - Maintenance Manual
 - 1. This Contractor shall submit one (1) bound copy in 8-1/2" x 11" hard fiber binder for approval. After approval, furnish three (3) copies to the Architect.
 - 2. Format of Manual to be as follows:
 - a. First Page: Title of Job, Project Number, Owner, address, Date of Submittal, Name and Address of Contractor, Name of Architect.
 - b. Second Page: Index.
 - c. First Section: Written description of each system, where located in the building, how each part functions individually and how systems work as a whole. Conclude with list of items requiring service and the service needed or reference to the manufacturer's data in the Maintenance Manual which describes proper service.
 - d. Second Section: A copy of each shop drawing and/or submittal (final record issue) with an index at beginning of the Section.

- e. Third Section: A copy of each manufacturer's operating and maintenance instructions with an index at the beginning of the section.
 - f. Fourth Section: A list of all equipment used on the job, together with Contractor's purchase orders and supplier's name and address.
 - g. Fifth Section: Copy of equipment identification chart, lubrication schedule, warranty letter, and additional extended warranties.
- B. Personnel Instruction: Provide a minimum of two (2) hours total instruction to personnel selected by the Owner. Provide additional time as called for in other specification sections. Instructions shall include the following:
- 1. Location of items of equipment and explanation of what they do.
 - 2. Reference to Operation Maintenance Manual for record and clarity.
 - 3. Coordination of written and verbal instruction so that each is understood by personnel. Advise on maintenance and repairs.
 - 4. Prepare a certificate to be signed by the person or persons being instructed. Certificate shall indicate date and time instructions were given, by whom given, and that the persons receiving the instructions fully understood the system operation.
- C. Record Set of Contract Drawings
- 1. Provide a clean set of Contract Drawing prints marked in red pencil, showing all deviations from the Contract Drawings. Record Drawings shall show all underground piping by dimension from building walls, and depth below grade or slab.
 - 2. Prints to be maintained at Project and kept current every day with job progress throughout Contract period.
 - 3. Upon completion of the project and before final approval neatly transcribe (in red pencil only) these deviations from the field drawings to a separate clean set of record drawings. Certify to the accuracy of each print by signature and date thereon and deliver same to the Architect.
 - 4. Sheet metal contractor shall update their shop drawings. Updated drawings shall be given to the Architect in electronic format on CD-Rom disk.

1.08 JOB CLOSING SUBMITTALS

- A. Following submittals to be forwarded to the Architect prior to building acceptance.
- 1. Operation and Maintenance Manuals.
 - 2. Certificate from designated personnel that they have received instructions and understand operations of systems.
 - 3. Record Drawings.
 - 4. Valve and Equipment Charts.
 - 5. Written letter of Guarantee and Warranties.
 - 6. Written notification of Punch List completion.
 - 7. Return of any building keys.
 - 8. Written letter of completion.
 - 9. Final payment request.
 - 10. Waiver of Lien.
 - 11. Certified payroll affidavit.
 - 12. HVAC submittals
 - a. Air Balance Report
 - b. Control diagrams
- B. Refer to Division 01 - General Requirements for additional closeout submittals.

1.09 INSPECTION OF SITE

- A. The Bidder's failure to become acquainted with the extent and nature of work required to complete any portion of the Work in conformity with the requirements of the Contract Documents shall not be a basis for additional compensation. Bidders are encouraged to visit the site during bidding period to examine and evaluate the Site and related Project Conditions where the work will be performed.

1.10 TEMPORARY FACILITIES

- A. If the building HVAC systems are used during Construction, then the building HVAC systems shall be adequately protected to the satisfaction of the Engineer to assure that the building HVAC system is like new when it is turned over to the Owner. The HVAC Contractor shall install a clean set of filters in the units after all start-up and commissioning has been completed. No units shall be operated without filters in place! Units operated without filters shall be restored to a like new condition by this Contractor at no additional cost to the Owner.

1.11 CONSTRUCTION SCHEDULE AND PHASING

- A. Upon approval of Contract, prepare a schedule, prior to starting operations, of all stages of work and sequence to be performed.
- B. Scheduling and associated approval procedures to be in accordance with General Conditions and Division 01 - General Requirements or as instructed by the Architect.
- C. Refer to Division 01 - General Requirements for areas of Building where special scheduling of work and restricted working hours will be in effect.
- D. The Architect in conjunction with the Owner, shall alone determine availability of spaces. No work to be performed which will hinder normal functions without expressed permission.
- E. Scheduling of work to be coordinated with delivery schedules and work schedules prepared by other Contractors directly involved.
- F. Required heating, cooling, and water outages to be scheduled and approved in advance with the Owner in coordination with the Architect.
- G. Materials and equipment required during a scheduled outage are to be on hand prior to starting of operations in order to ensure expeditious conclusion.
- H. The adjacent building will be occupied and in normal operation during entire period of construction. Work must be carefully coordinated and scheduled to minimize interference.

1.12 INTERRUPTION OF OPERATIONS AND UTILITIES

- A. Bidders are cautioned that disruption of utility services may be done only as scheduled in advance with the Architect and as approved by the Owner whose approval shall be final and binding to the Contract.
- B. Interruption of heating, cooling, and water services necessary for the reconnections of this Contract work shall be scheduled as follows:
 - 1. Submit a request in writing to the Architect at least fourteen (14) days in advance of the desired outages. Request shall state the service proposed for interruption, the duration of the interruption, the areas affected and an optional date or dates for the interruption. The request shall further certify that all materials and equipment necessary for completing work involved in the outage is on hand at the Site.
- C. The decision of the scheduled times of interruption by the Architect shall be final and binding on the Contract and no claim for extra compensation to the Contract may be made for overtime work necessary for interruptions outside of normal working hours.
- D. Work in corridors and traffic areas shall be scheduled and carried on so as not to impede, hamper, or be a nuisance to visitors or employees. Daily clean up of debris is required.

PART 2 PRODUCTS

2.01 NOT USED.

PART 3 EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 23 05 05 - HVAC BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.01 LUBRICATION

- A. Lubricate all bearings of rotating equipment furnished under this Contract before start-up in accordance with manufacturer's recommendations.
- B. This Contractor shall be responsible for continued lubrication until the time of final acceptance of his work.
- C. Factory sealed bearings do not require field lubrication.
- D. Lubrication Schedule: The following is a lubrication guide based on both temperature and environmental conditions. Special precautions shall be taken to assure that bearings are not over-lubricated.

Operating Conditions	Operating Conditions	Bearing	Greasing
Moisture	Dirt	Operating Temp.	Intervals
None	Fairly Clean	32 deg.F to 110 deg.F	6 to 12 months
None	Fairly Clean	110 deg.F to 160 deg.F	1 to 12 months
None	Fairly Clean	160 deg.F to 200 deg.F	1 to 4 weeks
None	Moderately to Extremely Dirty	32 deg.F to 150 deg.F	1 to 4 weeks
None	Moderately to Extremely Dirty	150 deg.F to 200 deg.F	1 week
Dir. Water Splashing	Fairly Clean	32 deg.F to 200 deg.F	1 week

1.02 TESTS

- A. Furnish tools, instruments and equipment required for performing tests, and make required temporary connections. Defects which develop under tests to be repaired promptly and tests to be repeated. Caulking of screwed joints, cracks, or holes is not permitted. Leaks to be repaired by tightening joints or by replacing pipe, fittings or equipment with new materials. Minor leaks in welded joints may be chipped out and rewelded. A general sweating may be cause for rejection of joints.
- B. Testing of service lines shall follow recommended code practices. When lines are tested with water pressure, remove all air to prevent false pressure readings.
- C. Pressure and Duration of Tests: Lines shall be tested with the test fluid at pressures indicated for a period of not less than 6 hours and shall show no drop in pressure:

1. SCHEDULE

<u>Line</u>	<u>Test Fluid</u>	<u>Pressure Not Less Than</u>
HWS & HWR	Water	125 psi
Chilled Water	Water	125 psi
Condensate Drain	Water/Air	5 PSI/ 30 Minutes

- D. All tests are to be made before piping is concealed or covered. Completely drain the systems after hydrostatic tests are performed. Damages caused by freezing prior to acceptance of the completed installation shall be repaired at no cost to the Owner. Tests are to be witnessed by the Architect's representative or as directed.
- E. Any elements of the systems which may be damaged by the test pressure shall be temporarily removed, isolated or bypassed. After successful completion of the tests, return the system to

operating condition including reinstallation of any removed, isolated, or bypassed system elements.

- F. Underground and buried lines shall be tested for a period of 24 hours at one-and- one-half times the normal working pressure. Lines that cannot be isolated from existing systems shall be tested at normal operating pressure.
- G. Testing High Velocity Ductwork and System
 - 1. Each duct system shall be tested for air tightness using the GENERAL PROCEDURES specified in the SMACNA "HVAC Duct Leakage Test Manual", 2012.
 - 2. Test pressure shall be the construction design working pressure of each duct system.
 - 3. In lieu of using the "Leakage Classification" allowance described in Section 4 of the SMACNA Manual, the tests shall be conducted to show that the total air leakage of each system is less than 1% of the maximum total air volume handled by each system.
 - 4. Allowable duct leakage shall not be confined to any one section of a system because of objectionable noise generation and concentration.
 - 5. Before final connections to high velocity boxes are made, the entire system shall be cleaned out and blown out.
 - 6. The Architect's representative shall be notified, so that tests may be witnessed.
- H. All pressure testing using a gaseous test fluid shall be done using recording line charts to record system pressure throughout the duration of the test.

1.03 CLEANING AND PAINTING

- A. Cleaning
 - 1. General: Clean systems and equipment before final inspection by the Architect and acceptance by the Owner. After cleaning, protect equipment and systems to minimize dirt and damage.
 - 2. Equipment: Clean rust appearing on factory finished equipment, prime and touch-up paint in kind. Repaint equipment to restore factory finish when directed by the Architect. Clean gauges and thermometers.
 - 3. Piping: After piping has been tested and approved, clean and prepare for painting. Exposed copper pipe to be cleaned with emery cloth and steel wool and wiped clean with solvent. Clean exposed galvanized piping which is to be painted with dilute acetic acid.
 - 4. Ductwork: Clean interior of ductwork and plenums to remove dust and foreign materials. Do not operate systems without filters. After ductwork has been approved, clean and prepare for painting or insulation.
- B. Painting
 - 1. Refer to Division 9
 - 2. Where not painted by the General Contractor, all exposed hangers, uninsulated pipes, stands, valves, supports, mounts, and pump bases, to be painted with (1) prime coat and one (1) finish coat by this Contractor. Prime coat shall be quick-drying, rust-inhibitive, alkyd-based primer. Finish coat shall be semi-gloss, acrylic-latex, interior enamel.
 - 3. This Contractor shall paint all weather exposed steel including exterior pipes and flashing: Prime coat shall be quick-drying, rust-inhibitive, alkyd-based primer. Furnish two (2) finish coats of semi-gloss, acrylic-latex, exterior enamel.
 - 4. Pipe and Ductwork: Exposed pipes and ductwork inside the Building to be painted under Division 9.
 - 5. Shop-primed items do not require field priming, except where shop-primer has been damaged exposing bare metal.

1.04 MOTORS AND WIRING

- A. Field Equipment and Wiring
 - 1. Electrical Contractor to provide conduit and wiring for devices as indicated on Electrical Drawings and in Specifications. Additional wiring required for equipment furnished under this Division shall be a responsibility of this Contractor.

2. All wiring shall be installed in metal conduit and shall comply with latest edition of National Electrical Code, NFPA 70, and with the Electrical Division of these Specifications, Division 26.
 3. Furnish to Electrical Contractor approved wiring diagrams required for HVAC and temperature control systems and be responsible for the successful operation of systems.
 4. Reimburse the Electrical Contractor for any changes, caused by installation of other than base equipment, in wiring and devices required to provide proper connections to equipment furnished. Wiring changes to be submitted to the Architect for review, prior to installation.
 5. Furnish to Electrical Contractor for mounting, spare fuses for equipment with internal fusing in the amounts of 1/3 of the installed quantity at each rating but in no case less than 3 fuses of each rating.
- B. Motors and Starters
1. Furnish motors for motor driven equipment. Motor horsepower requirements are, in general, specified with equipment. In no instance shall nameplate motor horsepower rating be less than the brake horsepower requirements of the equipment at startup and at specified operating conditions, or less than that shown. Motor service factor to be 1.15.
 2. Motor sizes shown on Drawings are for base Specification equipment. Equipment manufacturers to be responsible for electrical changes required for installation of their equipment.
 3. Motor starters, where specifically noted to be furnished with equipment specified herein, to be magnetic type, NEMA design with hot leg overload protection complete with properly sized heater elements.
 4. Unless otherwise specified, 3 phase motors 3/4 HP and larger to be open drip-proof, NEMA Design B; single phase motors 1/2 HP and less to be permanent-split capacitor or capacitor-start type. Insulation Class "B," "F," or "H." Minimum nominal efficiencies shall be in accordance with ASHRAE Standard 90.1-2004, Table 10-8.
 5. Motors to be used for a Variable Air Volume application shall be of special high efficiency design to provide optimized efficiency performance at partial load conditions encountered in variable air volume applications. Motor efficiency testing shall be in accordance with IEEE-112 method B and NEMA MG-1-12.53a. These motors shall maintain the following minimum efficiencies at each of the four load points (quarter, half, three-quarter, and full rated load):

Motor Horsepower		Minimum Efficiency
5 HP, 7.5 HP		85%
10 HP, 15 HP		88%
20 HP, 25 HP		90%
30 HP, 40 HP		91%
50 HP, 60 HP		92%
75 HP and above		93%
 6. Motors to be furnished with adjustable bases for belt driven equipment and with flexible couplings for direct-connected equipment.
- C. Factory Wiring
1. Factory wiring to be with copper wire. Wiring exposed to weather to be in liquid tight flexible conduit.
 2. Motors with factory installed power circuit wiring to an external strip or junction box to be furnished with a green equipment grounding conductor from the motor junction box to the external terminal strip or junction box.
 3. Internal overcurrent protection to be with Bussmann "Low Peak" fuses.
 4. Terminal boxes and control cabinets to have terminals permanently identified as shown on equipment wiring diagram with engraved, plastic identification plates held in place by screws. Terminal blocks to have two (2) screwed connection on a common bus block for separate incoming and outgoing connections. Factory mounted electrical components to be factory wired to separate individual terminal blocks.

5. Factory wiring including terminals, wiring compartments and power and grounding conductors to comply with the latest edition of National Electrical Code, NFPA 70, and with Electrical Division of these Specifications, Division 26.
6. Disconnect switches scheduled with equipment to be 250 volts rated for 240 volt or less system; and 600 volt for 480 volt system and to have a NEMA horsepower rating.

1.05 V-BELTS AND SHEAVES

- A. V-Belts to be constructed of fiberglass cords and fabric impregnated with and imbedded in rubber. Where more than one (1) belt is used furnish machine matched sets.
- B. Drives shall always be installed with provisions for center distance adjustment. Motors shall be located on their respective motor bases allowing for 1/6 of the total motor base travel for installation of new belts. The remaining 5/6 of the travel to be available for belt tightening.
- C. Arc of contact on the smaller sheave should not be less than 120 deg.
- D. Sheave ratios shall not exceed 8 to 1. Belt speeds shall not exceed 5000 feet per minute. In all cases, there shall be a full and free circulation of air around drive.
- E. Use variable pitch pulleys on motors 3 HP and smaller. Use fixed pulleys on motors 5 HP and larger. Provide additional sheaves as required to obtain air flow requirements during air balance.

1.06 ACCESS PANELS

- A. This Contractor shall furnish all access panels required for proper access whether shown on the Drawings or not. Panels shall meet the requirements of Division 8.
- B. All access panels shall be installed by the HVAC Contractor.

1.07 CLEANING OUT PIPING SYSTEMS

- A. The Contractor shall furnish labor and chemicals to clean all piping systems installed under this Contract.
- B. The Contractor shall employ the services of a Water Treatment Specialist employed by a recognized chemical manufacturer or by an independent laboratory to supervise cleaning of the systems. Specialist shall certify in writing to the Architect that the systems are clean.
- C. System shall be cleaned with a compound suitable to remove all dirt, oil, grease, and other foreign contaminants. Compound shall be circulated throughout the systems for a sufficient period of time to clean the systems and then it shall be completely drained and the systems flushed. All strainers shall be cleaned by removing the baskets or screens.
- D. Manual cleaning (with means required) of all pipe interiors to be completed by the Contractor before and after installing flanges and other fittings on open ends of pipe, to ensure the HVAC pipe system will not incur any debris from this project's installation process.

1.08 VIBRATION ELIMINATORS

- A. Provide vibration isolators where shown on drawings. All isolators shall be products of one manufacturer only.
- B. Isolation devices to be selected for uniform deflection under imposed load where unequal distribution of weight occurs.
- C. Vibration eliminators to be designed for a minimum absorption efficiency of 95% for the disturbing frequencies of equipment furnished and piping systems installed.
- D. Isolation manufacturer to be responsible for selection of vibration eliminators and to guarantee in writing to meet the requirements of this Specification. Submittal prints to show design deflection selected. Pumps mounted on "slab on grade" need not be isolated.
- E. Vibration isolation systems exposed to outdoor environment to be weatherproofed in the following manner: steel parts to be hot dipped galvanized; bolts and springs to be cadmium plated and neoprene coated.

- F. Isolator manufacturer's shop drawing submittals to include a tabulation of the design data on the isolators including O.D.; free, operating, and solid heights of the springs; free and operating heights of the neoprene or fiberglass isolators; and isolation efficiency and static deflection based on the lowest operating speed of the equipment supported. Show weights of equipment isolated.
- G. The isolation is based on Kinetics Noise Control. Equivalent equipment by Vibration Mountings and Controls, Inc.; Mason Industries; Vibration Eliminators Co., Inc. or Vibra Sonics, Inc. may be furnished.

1.09 EQUIPMENT GUARDS

- A. General
 - 1. Provide equipment guards for all equipment furnished under this Division. In all cases, belt drives, shaft couplings, exposed rotation shaft ends, and fan wheels or blades shall be completely guarded. Include guards for fans inside equipment housings.
- B. Manufacturers
 - 1. Equipment guards may be furnished by the equipment manufacturer; or they may be provided by the Contractor. Equipment guards provided by equipment manufacturers must meet all requirements of this Specification section, or they must be modified by the Contractor for compliance herewith.
- C. Installation
 - 1. Equipment guards must be easily removable. Care shall be taken not to cover parts which require continual access for maintenance or observation, etc.; or provide access doors in the guards for these items.
- D. Description of Equipment
 - 1. Belt drive guards to be "open mesh" type when there is any chance that the closed type would impede air flow into fans or air flow required for cooling purposes. If closed type is provided, provide access door for visual inspection of belts.
 - 2. Provide a tachometer access hole with cover for ends of shafts. Belt drive guards are to be "full cover" type which means the drives shall be completely surrounded by the guard.
 - 3. The ends of all exposed rotating shafts shall be covered with a sheet metal guard, end and all four sides.
 - 4. Shaft coupling guards to be solid type for impact resistance.
 - 5. Fan wheel guards and fan blade guards shall not impede air flow.

1.10 EQUIPMENT FOUNDATIONS AND SUPPORTS

- A. Furnish and install all supports required for the installation of work provided under this Division.
- B. Floor mounted equipment shall be installed on 4" high concrete "housekeeping" pads furnished and installed by the General Contractor. Where installed on new or existing slabs, roughen same for bond, and form and pour pad for plan size required for equipment. Pads shall be steel trowel finished and have chamfered edges. Loose set masonry units shall not be used for bases.
- C. Furnish all structural steel supports for equipment of adequate strength, primed and finish painted with aluminum bronze.
- D. Anchor bolts set in concrete floors, pads, and decks shall be installed in strict accordance with manufacturer's recommendations using proper size and type drill bits.

1.11 REMOVALS, RELOCATIONS AND SALVAGE

- A. The Owner reserves the right to retain ownership of any items of equipment to be removed under this Contract. Such items that may be so designated in advance of removal shall be removed without damage by this Contractor and be stored on the Owner's premises where directed.
- B. All other removed materials and equipment not so designated shall become the property of this Contractor and be promptly removed from the premises.

- C. Any fixture or equipment identified to be salvaged and relocated shall be thoroughly cleaned and be placed in first class condition before installation as an obligation of the Contract whether or not otherwise specifically called for. Refer to Drawings for identification of equipment to be removed by this Contractor.
- D. All existing piping that is now inactive or is rendered inactive by the new work of this Contract shall be removed except that piping built into existing walls need not be removed, but shall be cut off in the wall behind the finish line.
- E. No removed valve or pipe may be reused in the new systems.
- F. The demolition drawings are schematic and show the intent of the demolition work. The Contractor is responsible for the removal of any equipment, ductwork or piping found in building, but not shown on drawings, which must be removed to complete work.

PART 2 PRODUCTS

2.01 NOT USED.

PART 3 EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 23 05 19 - METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pressure gauges and pressure gauge taps.
- B. Thermometers and thermometer wells.
- C. Static pressure gauges.

1.02 RELATED REQUIREMENTS

- A. Section 23 09 23 - Direct-Digital Control System for HVAC.
- B. Section 23 09 93 - Sequence of Operations for HVAC Controls.
- C. Section 23 21 13 - Hydronic Piping.

1.03 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.
- B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi; 2007.
- C. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.
- D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014.

1.04 SUBMITTALS

- A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.
- B. Project Record Documents: Record actual locations of components and instrumentation.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

- A. Manufacturers:
 - 1. Weiss Instruments, Inc.: www.weissinstruments.com
 - 2. Marshall Instruments, Inc.: www.marshallinstruments.com
 - 3. Ashcroft, Inc.: www.ashcroft.com
 - 4. H.O. Trerice Co.: www.hotrerice.com
 - 5. Weksler Glass Thermometer Corp.: www.wekslerglass.com.
 - 6. Miljoco Corp.: www.miljoco.com
- B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
 - 1. Case: Cast aluminum with phosphor bronze bourdon tube.
 - 2. Size: 4-1/2 inch diameter.
 - 3. Mid-Scale Accuracy: One percent.
 - 4. Scale: Psi.

2.02 PRESSURE GAUGE TAPPINGS

- A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.
- B. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

2.03 STEM TYPE THERMOMETERS

- A. Manufacturers:
 - 1. Weiss Instruments, Inc.: www.weissinstruments.com
 - 2. H.O. Trerice Co.: www.hotrerice.com
 - 3. Marsh Bellofram: www.marshbellofram.com
 - 4. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
 - 5. Miljoco Corp.: www.miljoco.com

- B. Thermometer: ASTM E 1, adjustable angle, organic spirit-filled, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
 - 1. Size: 9 inch scale.
 - 2. Window: Clear Lexan.
 - 3. Stem: 3/4 inch NPT brass.
 - 4. Accuracy: 2 percent, per ASTM E77.
 - 5. Calibration: Degrees F.

2.04 THERMOMETER SUPPORTS

- A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

2.05 TEST PLUGS

- A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F.

2.06 STATIC PRESSURE GAUGES

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - 2. Weiss Instruments, Inc.: www.weissinstruments.com
 - 3. H.O. Trerice Co.: www.hotrerice.com
 - 4. Marsh Bellofram: www.marshbellofram.com
 - 5. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
- B. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.
- C. Gage shall have SPDT form "C" relay to alarm DDC control system when static pressure exceeds air filter setpoint indicating dirty filter.
- D. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Extend nipples to allow clearance from insulation.
- C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- D. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.
- E. Coil and conceal excess capillary on remote element instruments.
- F. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- G. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- H. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- I. Locate test plugs where indicated.

3.02 SCHEDULE

- A. Pressure Gauges, Location and Scale Range:
 - 1. Pumps, 0 to 100 psi.

2. Expansion tanks, 0 to 100 psi.
3. Major coils - inlets and outlets, 0 to 100 psi.
4. Pressure reducing valves, 0 to 60 psi.
- B. Pressure Gauge Tappings, Location:
 1. Control valves 3/4 inch & larger - inlets and outlets.
- C. Stem Type Thermometers, Location and Scale Range:
 1. Chilled Water Coil Banks - inlets and outlets, 0 to 120 degrees F.
 2. Hot Water Coil Banks - inlets and outlets, 30 to 240 degrees F.
- D. Thermometer Sockets, Location:
 1. Reheat coils - inlets and outlets.
 2. Cabinet heaters - inlets and outlets.
 3. Unit heaters - inlets and outlets.
- E. Static Pressure and Filter Gauges, Location and Scale Range:
 1. Unitary filter sections, 0 to 2 inches W.C..
 2. Building static, -0.05 to 0.2 inches W.C.

END OF SECTION

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Vibration isolators.

1.02 REFERENCE STANDARDS

- A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; 2015.

1.03 SUBMITTALS

- A. See Section 01 33 00 Submittal Procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 - 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
- C. Shop Drawings:
 - 1. Provide schedule of vibration isolator type with location and load on each.
 - 2. Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.

1.04 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 - 1. Select vibration isolators to provide required static deflection.
 - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

2.02 VIBRATION ISOLATORS

- A. General Requirements:
 - 1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
 - 2. Spring Elements for Spring Isolators:
 - a. Color code or otherwise identify springs to indicate load capacity.
 - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
 - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
 - d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
 - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
 - f. Selected to function without undue stress or overloading.

- B. Vibration Isolators for Nonseismic Applications:
1. Resilient Material Isolator Pads:
 - a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
 - b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
 - c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
 2. Open (Unhoused) Spring Isolators:
 - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
 - b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
 - c. Furnished with integral leveling device for positioning and securing supported equipment.
 3. Resilient Material Isolator Hangers, Nonseismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
 4. Spring Isolator Hangers, Nonseismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
 5. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

PART 3 EXECUTION

3.01 COORDINATION AND EXECUTION

- A. Coordinate size, shape, reinforcement and attachment of all housekeeping pads supporting vibration/seismically rated equipment. Concrete shall have a minimum compressive strength of 3,000 psi or as specified by the project engineer. Coordinate size, thickness, doweling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation and seismic restraint device manufacturer to ensure adequate space, embedment and prevent edge breakout failures. Pads and piers must be adequately doweled in to structural slab.
- B. Housekeeping Pads must be adequately reinforced and adequately sized for proper installation of equipment anchors. Refer to manufacturer's written instructions.
- C. Coordinate with vibration/seismic restraint manufacturer and the structural engineer of record to locate and size structural supports underneath vibration/seismically restrained equipment (e.g. roof curbs, cooling towers and other similar equipment). Installation of all seismic restraint materials specified in this section shall be accomplished as per the manufacturer's written instructions. Adjust isolators and restraints after piping systems have been filled and equipment is at its operating weight, following the manufacturer's written instructions.
- D. Isolated and restrained equipment, duct and piping located on roofs must be attached to the structure. Supports (e.g., sleepers) that are not attached to the structure will not be acceptable.

3.02 SCHEDULE

- A. Suspended Equipment: Combination Resilient Material/Spring Isolator Hangers.
- B. Ductwork: Vibration isolators not required.
- C. Piping: Install vibration hangers or stands within 10 feet of connection to air handlers and rotating equipment.

3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- E. Vibration Isolation Systems:
 - 1. Spring Isolators:
 - a. Position equipment at operating height; provide temporary blocking as required.
 - b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
 - c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
 - 2. Isolator Hangers:
 - a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
 - b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
 - 3. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 - 4. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
 - 5. Adjust isolators to be free of isolation short circuits during normal operation.
 - 6. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Ceiling tacks.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.03 SUBMITTALS

- A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Air Terminal Units: Nameplates and ceiling tacks, where located above ceiling..
- C. Automatic Controls: Tags. Key to control schematic.
- D. Control Panels: Nameplates.
- E. Dampers: Ceiling tacks, where located above lay-in ceiling.
- F. Fans: Nameplates
- G. Major Control Components: Nameplates.
- H. Piping: Pipe markers.
- I. Pumps: Nameplates.
- J. Tanks: Nameplates.
- K. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Brady Corporation: www.bradycorp.com
 - 2. Champion America, Inc.: www.Champion-America.com
 - 3. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
 - 4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 5. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
- B. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.
 - 4. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Manufacturers:
 - 1. Champion America, Inc.: www.Champion-America.com
 - 2. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.

3. Brady Corporation: www.bradycorp.com/#sle.
 4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 5. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

- A. Manufacturers:
1. Brady Corporation: www.bradycorp.com/#sle.
 2. Champion America, Inc.: www.Champion-America.com
 3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 4. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
- B. Color: Comply with ASME A13.1.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

2.05 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.
- B. Color code as follows:
1. HVAC Equipment: Yellow.
 2. Fire Dampers and Smoke Dampers: Red.
 3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Use tags on piping 3/4 inch diameter and smaller.
1. Identify service, flow direction, and pressure.
 2. Install in clear view and align with axis of piping.
 3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- F. Identify fans, air handlers, boilers, pumps, and unit heaters with plastic nameplates.
- G. Identify valves in main and branch piping with tags.
- H. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.
- I. Identify piping at connections to coils and other equipment; at entrances to spaces; adjacent to valves; near access doors to pipe spaces; and at 30-foot maximum intervals on long pipe runs.

- J. Piping identification shall be positioned to be easily read from a normal standing position.
- K. Piping tag colors to follow ASME (ANSI) A13.1 pipe marking requirements.

END OF SECTION

SECTION 23 05 55 - HVAC SLEEVES AND FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Penetrations of partitions, floors, and roofs.
- B. Firestopping materials.
- C. Firestopping of all penetrations and interruptions to fire rated assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 REFERENCES

- A. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2005a.
- B. ASTM E 814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2002.
- C. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- D. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

- A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

1.04 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs which provide the specified fire ratings when tested in accordance with methods indicated, ASTM E 814, and ASTM E 119.
 - 1. Listing in the current-year classification or certification books of UL or FM will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Stop System
 - 1. Hilti USA: www.us.hilti.com (Basis of Design).
 - 2. Tremco: www.tremcofirestop.com
 - 3. Nelson Firestop Products: www.nelsonfirestop.com
 - 4. Flame Stop, Inc.: www.flamestop.com
 - 5. 3M Fire Protection Products: www.3m.com/firestop.
- B. Pipe Curb Assemblies
 - 1. The Pate Company: www.patecurbs.com (Basis of Design).
 - 2. Thybar Corp.: www.thybar.com
 - 3. Roof Products & Systems Corp: www.rpscurbs.com

2.02 SLEEVES AND COLLARS

- A. Where pipes pass through walls, roofs or floors, provide sleeves as follows:

1. Sleeves for bare steel or insulated copper and steel pipe to be standard Schedule 40 black steel pipe.
2. Sleeves for bare copper pipes through walls or roof shall be Type "M" hard copper tubing.
- B. Where ducts pass through walls, roofs or floors, provide sleeves specified as follows:
 1. Sleeves for ducts shall be 18 gauge black steel.
 2. Ducts exposed to view passing through walls, floors, or ceilings shall have 20 gauge sheet metal collars to cover opening.
- C. Pipe Curb Assembly - Galvanized steel construction with wood nailer, 1-1/2" thick fiberglass board insulation, acrylic clad ABS thermo plastic cover with graduated step neoprene boot(s) with stainless steel band clamps. Hole size and arrangement as required.
- D. Pipe Seal - Spun aluminum base with surface flange, graduated step neoprene boot and stainless steel clamps.

2.03 FIRESTOPPING

- A. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. For penetrations by non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following materials are acceptable:
 1. Hilti FS 601 Elastomeric Firestop Sealant
 2. Hilti FS-ONE High Performance Intumescent Firestop Sealant.
 3. 3M Fire Stop Sealant 2000
 4. 3M Fire Barrier CP25 WB
 5. Tremco Tremstop Fyre-Sil Sealant
- C. For penetrations by combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems), the following materials are acceptable:
 1. Hilti FS-ONE High Performance Intumescent Firestop Sealant
 2. Hilti CP 642 Firestop Jacket
 3. Hilti CP 643 Firestop Jacket
 4. 3M Fire Barrier CP25 WB
 5. 3M Fire Barrier FS-195 Wrap/Strip
 6. Tremco Tremstop WBM Intumescent Firestop Sealant
- D. For penetrations by combustible plastic conduit, the following materials are acceptable:
 1. Hilti CP 642 Firestop Jacket
 2. Hilti CP 643 Firestop Jacket
 3. Hilti FS-ONE High Performance Intumescent Firestop Sealant.
 4. 3M Fire Barrier PPD Plastic Pipe Device
- E. For large size/complex penetrations made to accommodate cable trays, multiple conduits or electrical busways, the following materials are acceptable:
 1. Hilti FS 635 Trowelable Firestop Compound
 2. Hilti FIRE BLOCK
 3. 3M Firestop Foam 2001
 4. 3M Fire Barrier CS-195 Composite Sheet
 5. Others as approved equal by Engineer

PART 3 EXECUTION

3.01 SLEEVES AND COLLARS

- A. Where pipes pass through walls, roofs or floors, provide sleeves as follows:
 1. In new floors, sleeves shall be set in place before floor is cast. Openings through existing floors shall be made where possible, by drilling. Sleeves shall be mechanically fastened to the structure and the annular opening between sleeve and building structure to be rebuilt

with cement mortar. Space between pipe and sleeve or insulation and sleeve shall be fire stopped. Sleeves through waterproofed floors shall extend 4" above floor. Sleeves in equipment room floors shall extend 1-1/4" above the floor. Sleeves in other locations shall extend 3/4" above the floor. Provide chrome plated escutcheon rings.

2. Openings through walls shall be made by removing masonry units and rebuilding to match the existing construction. Length of sleeves shall be such that sleeve ends set flush with the wall surface. Pack sleeves for fire stopping same as through floors. Sleeves thru rated walls shall be firestopped.
 3. Openings for pipes thru walls, floors, or ceilings shall be closed by 20 gauge sheet metal collars attached to structure. Collars for firestopping shall take precedence.
 4. Furnish and install chrome-plated escutcheon plates on all exposed pipes at floors, walls, or ceilings, under sink cabinets and on fixture supplies.
- B. Where ducts pass through walls, roofs or floors, provide sleeves specified as follows:
1. The proper location of the sleeves shall be the responsibility of the HVAC Contractor. Each sleeve shall be installed perpendicular to the surface in which it is placed. All sleeves shall be machine cut.
 2. Wall sleeves shall be set flush with the finished wall.
- C. All insulation shall be continuous through sleeves, except at fire dampers.
- D. Sleeves shall be sized to allow not less than 1/4" clearance all around bare pipe, duct, or pipe insulation.
- E. The void between sleeves and ducts through outside walls, roofs, floors, or fire and smoke partitions shall be fire-stopped.
- F. Openings through unrated walls shall be sound-stopped by packing with fiberglass insulation retained by collars or other suitable means.
- G. Duct openings through rated walls shall have sleeves installed to receive the fire or smoke damper as required by NFPA 90A.
- H. Provide pipe curb assembly for multiple pipes penetrating roof. Provide pipe seal for individual pipes penetrating roof. Install per manufacturer's requirements.

3.02 FIRESTOPPING

- A. Provide a firestop system with an "F" Rating as determined by UL1479 of ASTM E814 which is equal to the time rating of construction being penetrated.
- B. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction being penetrated.
- C. Provide protection to prevent firestopping from contacting adjoining surfaces that will remain exposed and that would be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials.
- D. Identify firestopping with labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestopping installation where the labels will be visible to anyone seeking to remove penetrating items or firestopping.

3.03 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.04 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
- B. Remove incompatible materials which may affect bond.
- C. Install backing materials to arrest liquid material leakage.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Testing, adjustment, and balancing of hydronic systems.
- C. Field quality-control testing of Laboratory fume hoods.
- D. Measurement of final operating condition of HVAC systems.

1.02 GENERAL

- A. Testing, Adjusting, and Balancing services will be provided by a firm hired by and administered by the Contractor. The TAB agency as part of its contract shall act as authorized inspection agency, responsible to the Contractor and shall during the TAB list all items that are installed incorrectly, require correction, or have not been installed in accordance with Contract Documents, pertaining to the air distribution systems. The Contractor shall correct all items noted by the TAB agency and the balance work shall be completed before submitting report to the Architect for review. The HVAC Contractor shall include the cost of obtaining the TAB agency in its bid.
- B. The HVAC Contractor shall cooperate with the TAB agency in the following manner:
 - 1. Provide sufficient time before final completion date so that TAB can be accomplished.
 - 2. Provide immediate labor and tools to make corrections when required without undue delay.
 - 3. HVAC Contractor shall put all new and modified HVAC systems and equipment into full operation and shall continue the operation of same during each working day of TAB work.
 - 4. Keep TAB agency informed of any major changes made to the systems during construction, and provide TAB agency with a complete set of record drawings.
 - 5. Make available during testing an employee from the Sheetmetal Subcontractor and the Temperature Control Subcontractor to assist the TAB agency in their work. These individuals need not accompany the balancer full-time, but must be available to respond to problems when they arise.
- C. HVAC installation shall not be considered complete until final report by TAB agency is approved by Architect.

1.03 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.
- B. ASHRAE Std 110 - Methods of Testing Performance of Laboratory Fume Hoods; 2016.
- C. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.
- D. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; 2005, Seventh Edition.
- E. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.04 SUBMITTALS

- A. See Section 01 33 00 Submittal Procedures.
- B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit to Architect.
 - 2. Include at least the following in the plan:
 - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.

- b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - d. Final test report forms to be used.
 - e. Detailed step-by-step procedures for TAB work for each system and issue, including:
 - 1) Terminal flow calibration (for each terminal type).
 - 2) Diffuser proportioning.
 - 3) Branch/submain proportioning.
 - 4) Total flow calculations.
 - 5) Rechecking.
 - 6) Diversity issues.
 - f. Details of how TOTAL flow will be determined; for example:
 - 1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
 - 2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
 - g. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
 - h. Confirmation of understanding of the outside air ventilation criteria under all conditions.
 - i. Method of verifying and setting minimum outside air flow rate.
 - j. Time schedule for deferred or seasonal TAB work, if specified.
 - k. False loading of systems to complete TAB work, if specified.
 - l. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
 - m. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.
- E. Progress Reports:
- 1. Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 2. After all deficiencies have been resolved, complete water balance and submit final report for each construction phase. Progress report for each phase shall conform to the requirements of the paragraph "Final Report" below, and shall be approved by the Architect before work on the next phase can commence.
 - 3. At completion of the final phase, combine all reports into one final report.
- F. Final Report:
- 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
 - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 - 3. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
 - 4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 6. Units of Measure: Report data in I-P (inch-pound) units only.
 - 7. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.

- b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Architect.
 - g. Project Contractor.
 - h. Report date.
- G. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 - 2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
 - 3. Maintain at least one copy of the standard to be used at project site at all times.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Having minimum of three years documented experience.
 - 3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
- E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.
 - 12. Hydronic systems are flushed, filled, and vented.
 - 13. Pumps are rotating correctly.
 - 14. Proper strainer baskets are clean and in place.
 - 15. Service and balance valves are open.

- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
- B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.
- C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.
- D. Fume Hoods: Adjust airflow to maintain face velocity within 90-110 feet per minute with sash positioned at 18" open.

3.05 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
 - 1. Running log of events and issues.
 - 2. Discrepancies, deficient or uncompleted work by others.
 - 3. Contract interpretation requests.
 - 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
- E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.06 FUME HOOD TESTING (ON SITE)

- A. General: Test fume hoods as installed to assess airflow velocity, airflow visualization, and level of containment. Perform tests with static mode (set sash position) conditions. Conduct testing as outlined below for 100% of the hoods provided in the Project.
- B. Preparation: Visit the project site to confirm that construction activities related to the fume hood system(s) and equipment are complete. Review design documents and Contractor's submittals. Verify that mechanical ventilation systems serving the space are functioning and operating in the normal mode. Notify Owner in writing, if conditions exist which preclude proper fume hood testing. Starting of testing constitutes acceptance of site conditions.
- C. Testing Requirements:
 - 1. Perform the following tests, in order:
 - a. Airflow Velocity Test.
 - b. Airflow Visualization Test.
 - c. Tracer Gas Containment Test.
 - 2. If more than one test procedure is selected, proceed to the next test only if any unsafe condition discovered during current test has been successfully rectified.

3. Airflow Velocity Test: Comply with ASHRAE 110-2016.
4. Airflow Visualization Test: Comply with ASHRAE 110-2016.
5. Tracer Gas Containment Test:
 - a. Conduct a static mode test of the hood and laboratory configuration. Conduct testing in accordance with ASHRAE Std 110, except as modified herein:
 - 1) Test hood with simulated scientific apparatus set-up within the hood. Apparatus to consist of: two (2) each 1 gal. round paint cans, one (1) 1' by 1' by 1' cardboard box, and three (3) each 6" by 6" by 12" high cardboard boxes. Position these items from 6 to 10 inches behind the sash, randomly distributed, and supported off of the work surface by 2 inch by 2 inch by 2 inch block of any material.
 - 2) 6 liters per minute release rate for tracer gas.
 - 3) Conduct only at the center position for the manikin.
 - 4) Each tracer gas test duration to be 5 minutes.
 - 5) Acceptable test results will be 0.05 PPM or better.
 - 6) At the conclusion of each 5-minute test there will be three rapid walk-by at 1' behind the manikin. Each walk-by to be spaced 30 seconds apart. If a rise in test gas concentration occurs, it cannot exceed 0.10 ppm and must return to 0.05 ppm within 15 seconds.
 - 7) There must be a minimum of three and a maximum of five people in the space in which the fume hood is located during the test procedure.
 - 8) Representatives of the Architect, Engineer, Owner, and Contractor must witness the tests.
 - 9) Test of Alarm: Shut off the fume hood exhaust and verify that the individual fume hood alarm activates.
 - 10) Test individual controls: Test any controls that are provided at the fume hood such as unoccupied cycle override, alarm override, etc.
6. Reporting Requirements: Comply with Section 5 of NEBB (FHT) Fume Hood Testing Standard - current edition. Organize and include, at a minimum, the following information:
 - a. Report Title.
 - b. Report Certification.
 - c. Table of Contents.
 - d. Report Summary/ Remarks.
 - e. Appropriate Forms.
 - f. Instrument Calibration.
 - g. List of Abbreviations Used.
 - h. 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.

3.07 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- L. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- M. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.
- N. For variable air volume units set volume controllers to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.08 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.09 SCOPE

- A. Test, adjust, and balance the following:
 - 1. HVAC Pumps.
 - 2. Air Cooled Water Chillers.
 - 3. Air Coils.
 - 4. Air Handling Units.
 - 5. Fans.
 - 6. Air Terminal Units.
 - 7. Air Inlets and Outlets.
 - 8. Hood Exhaust (CFM and Face Velocity).

3.10 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
 - 1. Manufacturer.
 - 2. Model/Frame.
 - 3. HP/BHP.

4. Phase, voltage, amperage; nameplate, actual, no load.
 5. RPM.
 6. Service factor.
 7. Starter size, rating, heater elements.
 8. Sheave Make/Size/Bore.
- B. V-Belt Drives:
1. Identification/location.
 2. Required driven RPM.
 3. Driven sheave, diameter and RPM.
 4. Belt, size and quantity.
 5. Motor sheave diameter and RPM.
 6. Center to center distance, maximum, minimum, and actual.
- C. Pumps:
1. Identification/number.
 2. Manufacturer.
 3. Size/model.
 4. Impeller.
 5. Service.
 6. Design flow rate, pressure drop, BHP.
 7. Actual flow rate, pressure drop, BHP.
 8. Discharge pressure.
 9. Suction pressure.
 10. Total operating head pressure.
 11. Shut off, discharge and suction pressures.
 12. Shut off, total head pressure.
- D. Cooling Coils:
1. Identification/number.
 2. Location.
 3. Service.
 4. Manufacturer.
 5. Air flow, design and actual.
 6. Entering air DB temperature, design and actual.
 7. Entering air WB temperature, design and actual.
 8. Leaving air DB temperature, design and actual.
 9. Leaving air WB temperature, design and actual.
 10. Water flow, design and actual.
 11. Water pressure drop, design and actual.
 12. Entering water temperature, design and actual.
 13. Leaving water temperature, design and actual.
 14. Air pressure drop, design and actual.
- E. Heating Coils:
1. Identification/number.
 2. Location.
 3. Service.
 4. Manufacturer.
 5. Air flow, design and actual.
 6. Water flow, design and actual.
 7. Water pressure drop, design and actual.
 8. Entering water temperature, design and actual.
 9. Leaving water temperature, design and actual.
 10. Entering air temperature, design and actual.
 11. Leaving air temperature, design and actual.

12. Air pressure drop, design and actual.
- F. Electric Duct Heaters:
 1. Manufacturer.
 2. Identification/number.
 3. Location.
 4. Model number.
 5. Design kW.
 6. Number of stages.
 7. Phase, voltage, amperage.
 8. Test voltage (each phase).
 9. Test amperage (each phase).
 10. Air flow, specified and actual.
 11. Temperature rise, specified and actual.
- G. Air Moving Equipment:
 1. Location.
 2. Manufacturer.
 3. Model number.
 4. Serial number.
 5. Arrangement/Class/Discharge.
 6. Air flow, specified and actual.
 7. Return air flow, specified and actual.
 8. Outside air flow, specified and actual.
 9. Total static pressure (total external), specified and actual.
 10. Inlet pressure.
 11. Discharge pressure.
 12. Sheave Make/Size/Bore.
 13. Number of Belts/Make/Size.
 14. Fan RPM.
- H. Exhaust Fans:
 1. Location.
 2. Manufacturer.
 3. Model number.
 4. Serial number.
 5. Air flow, specified and actual.
 6. Total static pressure (total external), specified and actual.
 7. Inlet pressure.
 8. Discharge pressure.
 9. Sheave Make/Size/Bore.
 10. Number of Belts/Make/Size.
 11. Fan RPM.
- I. Duct Traverses:
 1. System zone/branch.
 2. Duct size.
 3. Area.
 4. Design velocity.
 5. Design air flow.
 6. Test velocity.
 7. Test air flow.
 8. Duct static pressure.
- J. Duct Leak Tests:
 1. Description of ductwork under test.
 2. Duct design operating pressure.

3. Duct design test static pressure.
 4. Duct capacity, air flow.
 5. Maximum allowable leakage duct capacity times leak factor.
 6. Test apparatus:
 - a. Blower.
 - b. Orifice, tube size.
 - c. Orifice size.
 - d. Calibrated.
 7. Test static pressure.
 8. Test orifice differential pressure.
 9. Leakage.
- K. Air Monitoring Stations:
1. Identification/location.
 2. System.
 3. Size.
 4. Area.
 5. Design velocity.
 6. Design air flow.
 7. Test velocity.
 8. Test air flow.
- L. Terminal Unit Data:
1. Manufacturer.
 2. Type, constant, variable, single, dual duct.
 3. Identification/number.
 4. Location.
 5. Model number.
 6. Size.
 7. Minimum static pressure.
 8. Minimum design air flow.
 9. Maximum design air flow.
 10. Maximum actual air flow.
 11. Inlet static pressure.
- M. Air Distribution Tests:
1. Air terminal number.
 2. Room number/location.
 3. Terminal type.
 4. Terminal size.
 5. Area factor.
 6. Design velocity.
 7. Design air flow.
 8. Test (final) velocity.
 9. Test (final) air flow.
 10. Percent of design air flow.

END OF SECTION

SECTION 23 07 13 - DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 53 - Identification for HVAC Piping and Equipment.
- B. Section 23 31 00 - HVAC Ducts and Casings: Glass fiber ducts.

1.03 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
- C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.
- D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2014.
- E. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.
- F. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts; 2011.
- G. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2008.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
- K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville: www.jm.com/#sle.
 - 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 1,200 degrees F.
 - 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
 - 4. Minimum Density: 3/4 pounds per cubic foot.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 - 3. Secure with pressure-sensitive tape.
- D. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.03 GLASS FIBER, RIGID

- A. Manufacturer:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville: www.jm.com/#sle.
 - 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corp: www.owenscorning.com.
- B. Insulation: ASTM C612; rigid, noncombustible blanket.
 - 1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 450 degrees F.
 - 3. Maximum Water Vapor Absorption: 5.0 percent.
 - 4. Minimum Density: 3 lb/cu ft.
- C. Vapor Barrier Jacket:
 - 1. ASJ - All service jacket.
 - 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 - 3. Secure with pressure-sensitive tape.
- D. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Insulated Ducts Conveying Air Below Ambient Temperature:
 - 1. Provide insulation with vapor barrier jackets.
 - 2. Finish with tape and vapor barrier jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated Ducts Conveying Air Above Ambient Temperature:
 - 1. Provide with or without standard vapor barrier jacket.
 - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.
- E. External Duct Insulation Application:
 - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 - 2. Secure insulation without vapor barrier with staples, tape, or wires.
 - 3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 - 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.

3.03 SCHEDULES

- A. Exhaust Ducts Within 10 ft of Exterior Openings:
 - 1. Exposed: Glass Fiber, Rigid, 1" thickness.
 - 2. Concealed: Glass Fiber, Flexible, 1-1/2" thickness.
- B. Outside Air Intake Ducts:
 - 1. Exposed in mechanical rooms: Glass fiber, rigid; 1-1/2" thickness.
 - 2. Concealed: Glass Fiber, Flexible, 1-1/2" thickness.
- C. Supply Ducts:
 - 1. In Mechanical Rooms and where exposed in unfinished spaces - Glass Fiber, Rigid, 1" thickness.
 - 2. Concealed - Glass Fiber, Flexible, 1-1/2" thickness.

END OF SECTION

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
- B. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.
- C. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, RIGID

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation: www.jm.com/#sle.
 - 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corp: www.owenscorning.com.

- B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
 - 1. K Value: ASTM C177, 0.24 at 75 degrees F.
 - 2. Maximum Service Temperature: 650 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- D. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.03 JACKETING AND ACCESSORIES

- A. PVC Plastic.
 - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil, 0.010 inch.
 - e. Connections: Brush on welding adhesive.
 - 2. Covering Adhesive Mastic: Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Insulated Pipes Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- D. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- E. For hot piping conveying fluids 140 degrees F or less, insulate piping, fittings, valves, strainers, flexible connections. Do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- F. For hot piping conveying fluids over 140 degrees F, insulate piping, fittings, valves, strainers, flexible connections. Insulate flanges and unions at equipment.
- G. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- H. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Insert location: Between support shield and piping and under the finish jacket.
 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.
 - J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.
 - K. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULE

- A. Heating Systems:
 1. Heating Water Supply and Return: Glass Fiber Insulation.
 - a. Thickness:
 - 1) Pipe diameter up to 1-1/2": 1.5" thickness.
 - 2) Pipe diameter 1-1/2" and larger: 2.0" thickness.
- B. Cooling Systems:
 1. Chilled Water:
 - a. Glass Fiber Insulation
 - 1) Pipe size 1-1/4" and smaller: 0.5" thickness.
 - 2) Pipe size 1-1/2" and larger: 1.0" thickness.
 2. Condensate Drains from Cooling Coils:
 - a. Glass Fiber Insulation, 1.0" thickness.

END OF SECTION

SECTION 23 09 23 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. System description.
- B. Operator interface.
- C. Controllers.
- D. Power supplies and line filtering.
- E. System software.
- F. Controller software.
- G. HVAC control programs.

1.02 SCOPE

- A. New Direct Digital Controls (DDC) shall be provided to control all new items of HVAC equipment.
- B. Failure to mention any specific item or device does not relieve the Contractor of the responsibility for installing or integrating such device/peripheral in order to comply with the intent of the Drawings or this Specification.
- C. The new DDC system shall fully integrate into the Owner's existing Honeywell system (herein referred to as the Building Management System, or BMS). The required integration shall include the creation of custom graphics and the compilation and display of all devices and objects on the existing Operator Workstation (OWS) and Webserver.
 - 1. All integration work, including creation of system graphics, shall be performed by Point-to-Point Systems, 620 E. First Street, Dayton, Ohio 45402 (800-685-2082), www.p2psystems.net, working for the Contractor. Integration Contractor shall thoroughly test all graphics to assure that all data is correctly mapped and shall coordinate any required corrections with the DDC Contractor.
- D. Building Automation System (BAS) Contractor shall provide:
 - 1. A fully integrated and fully programmable BACnet DDC control system, UL listed (UL916 and UL864 If applicable), incorporating direct digital control (DDC) for energy management, equipment monitoring and control.
 - 2. Necessary conduit, wiring, enclosures, and panels, for all DDC temperature control equipment and devices. Installation shall comply with applicable local and national codes. Top control panel conduit penetrations shall use a gasketed Meyers hub to prevent water infiltration.
 - 3. All components and control devices necessary to provide a complete and operable DDC system as specified herein.
 - 4. All final electrical connections to each new stand-alone DDC Controller. Connect to existing 120VAC power adjacent to existing control panel in second floor mechanical room.
 - 5. BAS Contractor shall be responsible for all electrical work associated with the BAS control system and as called for on the Drawings. This BAS control wiring shall be furnished and installed in accordance with the Electrical requirements as specified in Division 26, the National Electric Code, and all applicable local codes.
 - 6. Surge transient protection and uninterruptible power shall be incorporated in design of system to protect electrical components in all Building Controllers, Advanced Application Controllers and operator's workstations. Provide an external protection device listed under UL 1449 with minimum clamping voltage of 130 VRMS and surge current capability of 22,500 Amps for all custom fabricated control panels (all main system components [i.e., ERV, etc.]).
 - 7. All 120V and low voltage electrical control wiring exposed throughout the building shall be run in conduit in accordance with the Electrical requirements as specified in Division 26,

the National Electric Code, and all applicable local codes. All low voltage wiring that is concealed in accessible ceilings may be run in plenum rated cable per the National and Local Electrical codes.

8. All 24VAC power required for operation of the BAS system shall be by the DDC Contractor and shall be limited to 100 VA per the aforementioned codes. Any 24VAC power link that exceeds the 100 VA rating must be installed in conduit per Division 26 and all applicable codes, regardless of the nature of the installation.
 9. BAS Contractor shall provide programming modifications necessary to fine tune sequences during commissioning and through the warranty period of system and for an additional 12 months, at no extra cost to the Owner.
 10. BAS Contractor shall provide the following for the HVAC Contractor to install:
 - a. Control valves and sensor wells for piping systems.
 - b. Location of all required wells and openings for temperature, pressure, and flow sensors for piping systems.
 - c. Control dampers for air systems.
 - d. Location of all duct openings required for temperature, pressure, flow, and humidity sensors for air systems.
 11. BAS Contractor shall include the work of Section 23 09 95 Laboratory Airflow Control System in the scope of this Section.
- E. HVAC Contractor provides:
1. All wells and openings for water and air monitoring devices, temperature sensors, flow switches and alarms furnished by BAS Contractor.
 2. Installation of all control valves as per the contract drawings. The HVAC contractor is responsible for the correct installation of any hot or chilled water control valves. Valves shall be installed in accordance with manufacturer's installation instructions and BAS Contractor's recommendations.
 3. Installation of all dampers and adjacent access doors for outdoor air, return air, exhaust air, and ventilation dampers.
 4. All package unit control panels, including but not limited to, factory ERV panels and specialty interface modules, required for BACnet compliance. Package unit control panels shall communicate with the building automation system. Provide all integration required to view and adjust all points.
- F. Electrical Contractor provides:
1. Electrical contractor will provide smoke detector and smoke damper interlock and power wiring for all life safety applications.
- G. General Product Description:
1. The building automation system (BAS) shall integrate multiple building functions including equipment supervision and control, alarm management, energy management and historical data collection utilizing the BACnet protocol.
 2. The BAS system shall consist of the following:
 - a. Stand-alone peer-to-peer Building Controllers with 32 bit processors, a minimum of 2 MB of flash memory and 10 bit A/D converters. BACnet over Ethernet or BACnet over IP connectivity is required for all Building Level Controllers and Advanced Application Controllers.
 - b. Stand-alone peer-to-peer Advanced Application Controllers with 32 bit processors, a minimum of 1 MB flash memory and 10-bit A/D converters. AACs shall communicate via BACnet MS/TP with a minimum baud rate of 76.8 kbps. The use of ARCNET, LON, proprietary, or any other protocol other than BACnet is strictly prohibited.
 - c. Application Specific Controllers are not permitted at any level within the BAS system. All controllers must be Advanced Application Controllers and BTL listed.
 - d. Owner's work station computer with all graphics and BAS system management software (existing to remain).
 - e. All BACnet intrinsic alarming shall be disabled. All alarms shall reside in the local controller that is physically controlling the mechanical equipment. All alarms shall be

- setup as individual BACnet event objects, support BACnet Event Enrollment, and support auto generated alarm messages at the BBMD level for the local subnet.
3. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, Building Controllers, Advanced Application Controllers, expansion modules and operator devices.
 4. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC Controller shall operate independently by performing its own specified control, alarm management, operator I/O and data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices. Alarm management and data collection that requires a single mechanism for user notification or viewing is strictly prohibited. A local outside air temperature reference is required for each facility. The local temperature reference may be shared with other controllers within the local facility. Sharing the outside temperature values between facilities is strictly prohibited unless fail over logic is in place. If the network share fails then the panels have to refer to the local temperature reference for control.
 5. The MCES Environmental Laboratory building control points shall be completely separate from the existing Administration Building control points. No points shall be shared between the two buildings.
 6. All Controllers shall be able to access any data from, or send control commands and alarm reports directly to, any other DDC Controller or combination of controllers on the network without dependence upon a central processing device (peer-to-peer). All Controllers shall also be able to send alarm reports to multiple operator workstations without dependence upon a central processing device.
- H. System Lifecycle Support
1. BACnet Field Devices: Manufacturer shall provide product updates for the lifecycle of the installed DDC hardware at no additional cost to the Owner. Manufacturers shall provide software tools, licensing, and training necessary for the Owner's field technicians to deploy and install updates. Updates shall include all patches, firmware, and software revisions for the lifecycle of the hardware or until the manufacturer no longer provides support for the product. The requirement for these updates includes, but is not limited to, products with embedded OS, PLC's, building level controllers, advanced application controllers, application specific controllers, unitary controllers, and component interfaces.

1.03 RELATED REQUIREMENTS

- A. Section 23 05 05 - HVAC Basic Materials and Methods.
- B. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.
- C. Section 23 09 93 - Sequence of Operations for HVAC Controls.
- D. Section 23 09 95 - Laboratory Airflow Control System.
- E. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.
- F. Section 23 72 23 - Packaged Air-to-Air Energy Recovery Units.
- G. Materials furnished by the DDC contractor:
 1. DDC Contractor to furnish the following to the Heating, Ventilation and Air Conditioning Contractor for installation by the HVAC contractor:
 - a. Control valves and temperature sensor wells for wet systems
 - b. Location of all wells and openings for temperature, pressure, and flow sensors for pipe systems
 - c. Control dampers for air systems.
 - d. Location of all ducts and openings for temperature, pressure, flow, and humidity sensors for air systems.

1.04 REFERENCE STANDARDS

- A. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2012.
- B. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; 2019h.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 SUBMITTALS

- A. See Section 01 33 00 Submittal Procedures.
- B. Electronically submit a complete set of drawings showing the kind of control equipment for each of the various systems and their functions, along with indications on the drawing of all original setpoints and calibration values, and setup parameters, and sequence of operation of the automation system. These drawings shall be submitted for approval to the Architect, together with a complete brochure describing the equipment and their functions and operation. Include all application software documentation (actual programs or their job-specific flow charts) with DDC system and schedule a review meeting with the Owner and the Architect at least two weeks before installation and start up.
 - 1. Manufacturer's Product Data: Provide data for each equipment component.
 - 2. Shop Drawings:
 - a. System wiring diagrams with sequence of operation for each system as specified.
 - b. Submit manufacturer's product information on all hardware items along with descriptive literature for all software programs to show compliance with specifications.
 - c. System configuration diagram showing all panel types and locations as well as communications network and workstations.
- C. Where installation procedures, or any part thereof, are required to be in accord with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Architect prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received.

1.06 QUALITY ASSURANCE

- A. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.
- B. Install system using competent workmen who are fully trained and factory certified in the installation of temperature control equipment. The factory certified diplomas shall be readily available at the request of the Owner or Architect.
- C. The complete installation and proper operation of the BAS shall include debugging and calibration of each component in the entire system and shall be the single source responsibility of supplier. The BAS must be supplied and installed by the same controls contractor. Only Factory Authorized Distributors will be considered for installation. The letting of separate contracts by the prime HVAC Contractor for the Control System and a separate contract for its installation by a third party installer is strictly prohibited.
- D. Supplier shall have an in-place support facility within 50 miles of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.
- E. All electronic equipment shall conform to the requirements of FCC Regulations, Part 15, Subpart B, Class A, governing radio frequency electromagnetic interference, and be so labeled.
- F. BAS shall comply with, and be listed at time of bid for the following Underwriters Laboratories Standards:
 - 1. UL 916 for Energy Management Equipment, per category PAZX for Energy Management Equipment.
- G. Design and build all system components to be fault-tolerant.

1. Satisfactory operation without damage at 110% and 85% of rated voltage and at plus 3-Hertz variation in line frequency.
 2. Static, transient and short-circuit protection on all inputs and outputs.
 3. Protect communication lines against incorrect wiring, static transients and induced magnetic interference.
 4. Network-connected devices to be AC-coupled or equivalent so that any single device failure will not disrupt or halt network communication.
 5. All Building / System Controllers shall have real time clocks and data file RAM with battery and SRAM backup.
 6. All controllers shall be EEPROM, flash driven.
- H. The BAS Installer shall have a competent and factory certified Project Manager who is able to answer field questions, is aware of all schedules and schedule changes, and is responsible for the BAS Installer's work and the coordination of their work with all other trades. This Project Manager shall be available for onsite and shall respond to design, programming, and equipment related questions. Failure to provide the above services shall be considered a substantial breach of Contract Documents.

1.07 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures.
- B. Correct defective Work within a two year period after Substantial Completion.
- C. The BAS Contractor or manufacturer representative shall support the installed system for a minimum of two (2) years. The support shall include all software/firmware updates, full material warranty of actual controllers, devices and equipment, and on-site training and support.

PART 2 PRODUCTS

2.01 BACNET CONFORMANCE

- A. The Building Automation System (BAS) contractor shall supply a BACnet (ANSI/ASHRAE 135-2016) compliant system. Each device category and its required compliance are listed below under sections F-H. BACnet compatible systems that employ the use of proprietary 'gateways' will not be accepted unless otherwise noted.
- B. The BACnet system shall be capable of BACnet over Internet Protocol (IP) or BACnet over Ethernet communications. Annex J will be the basis of design for all BACnet/IP devices. All other configurations must be submitted prior to bid, in writing, for final approval.
- C. The primary Local Area Network (LAN) on the building's subnet shall be based upon the ISO 8802-3 Ethernet standard or BACnet/IP Annex J and will be required for all Building Controllers, System Controllers and Operator Work Stations. The use of MS/TP communications for interconnecting the said devices is strictly prohibited. The installation of all Ethernet wiring, accessories, and connectors shall conform to the ISO standard and/or guidelines identified herein. The connection media shall be Category 6, Unshielded Twisted Pair (UTP) wire. The maximum single network run shall not exceed 100 meters. The use of unmanaged switches, hubs, or daisy chaining Ethernet between controllers is prohibited. If a run exceeds 100m, fiber must be used with approved media converters.
- D. The secondary or sub-network shall utilize the Master-Slave/Token-Passing protocol, as acknowledged by the ANSI/ASHRAE 135 standard. Proprietary RS-485 or equivalent links will not be considered unless otherwise noted. The MS/TP link shall operate at a 76.8 Kbps minimum. If a 3rd party device is unable to communicate at 76.8Kbps it must be isolated to its own individual bus. Each MS/TP subnet bus shall consist of no more than 50 devices. All devices on a bus shall be subordinates of a single mechanical system. For example, putting VAVs that are served from two different AHUs on the same physical bus is strictly prohibited.
- E. The use of proprietary gateways to transmit input/output data, and/or related information, must reside on the Ethernet LAN and be approved, in writing, prior to the bid.
- F. Workstation conformance (B-AWS): The workstation must be scheduled or submitted to the BTL for future testing, under Device Profile B-AWS with support of the following BIBBs:

1. Alarm and Event Management BIBBs
 - a. AE-ACK-A, AE-ACK-B, AE-ASUM-A, AE-ASUM-B, AE-ESUB-A, AE-ESUM-B, AE-INFO-A, AE-INFO-B, AE-N-A, AE-N-E-B, AE-N-I-B
 2. Device Management BIBBs
 - a. DM-BR-A, DN-DCC-A, DM-DCC-B, DM-DDB-A, DM-DDB-B, DM-DOB-A, DM-DOB-B, DM-LM-A, DM-LM-B, DM-OCD-A, DM-OCD-B, DM-RD-A, DM-RD-B, DM-TM-B, DM-TS-A, DM-UTC-A
 3. Data Sharing BIBBs
 - a. DS-COV-A, DS-COV-B, DS-COVU-A, DS-COVU-B, DS-RP-A, DS-RP-B, DS-RPM-A, DS-RPM-B, DS-WP-A, DS-WP-B, DS-WPM-A, DS-WPM-B
 4. Network Management BIBBs
 - a. NM-CE-A, NM-CE-B
 5. Scheduling BIBBs
 - a. SCHED-A, SCHED-E-B, SCHED-I-B
 6. Trending
 - a. T-ATR-A, T-ATR-B, T-VMT-A, T-VMT-E-B, T-VMT-I-B
- G. Building Controller Conformance (BC): The building controller must be certified and listed by BTL (BACnet Testing Laboratory) under Device Profile B-BC (Annex L of the BACnet standard) with support of the following BIBBs:
1. Alarm and Event Management BIBBs
 - a. AE-ACK-B, AE-ASUM-B, AE-ESUM-B, AE-INFO-B, AE-N-A, AE-N-E-B, AE-N-I-B
 2. Device Management BIBBs
 - a. DM-BR-B, DM-DCC-B, DM-DDB-A, DM-DDB-B, DM-DOB-A, DM-DOB-B, DM-OCD-B, DM-RD-B, DM-TM-A, DM-TS-A, DM-TS-B, DM-UTC-A, DM-UTC-B
 3. Data Sharing BIBBs
 - a. DS-COV-A, DS-COV-B, DS-COVU-A, DS-COVU-B, DS-RP-A, DS-RP-B, DS-RPM-A, DS-RPM-B, DS-WP-A, DS-WP-B, DS-WPM-B
 4. Network Management BIBBs
 - a. NM-CE-A, NM-CE-B
 5. Scheduling BIBBs
 - a. SCHED-A, SCHED-E-B, SCHED-I-B
 6. Trending
 - a. T-ATR-B, T-VMT-E-B, T-VMT-I-B
- H. Advanced Application Controller Conformance (AAC): The AAC must be certified and listed by BTL (BACnet Testing Laboratory) under Device Profile B-AAC (Annex L of the BACnet standard) with support of the following BIBBs:
1. Alarm and Event Management BIBBs
 - a. AE-ACK-B, AE-ASUM-B, AE-ESUM-B, AE-INFO-B, AE-N-E-B, AE-N-I-B
 2. Device Management BIBBs
 - a. DM-BR-B, DM-DCC-B, DM-DDB-A, DM-DDB-B, DM-DOB-A, DM-DOB-B, DM-LM-B, DM-OCD-B, DM-RD-B, DM-TM-A, DM-TS-B, DM-UTC-B
 3. Data Sharing BIBBs
 - a. DS-COV-A, DS-COV-B, DS-COVU-A, DS-RP-A, DS-RP-B, DS-RPM-A, DS-RPM-B, DS-WP-A, DS-WP-B, DS-WPM-B
 4. Network Management BIBBs
 - a. NM-CE-A
 5. Scheduling BIBBs
 - a. SCHED-E-B, SCHED-I-B
 6. Trending
 - a. T-ATR-B, T-VMT-E-B, T-VMT-I-B
- I. Application Specific Controllers (ASC): ASCs will not be permitted on this project. The minimum level BACnet Controller that will be accepted shall be listed as a B-AAC device under the BTL certification process.

- J. Read / Write Properties: The entire BACnet BAS system (all OWS, BC, AAC and ASC devices) shall support the following Read/Write properties within the given BACnet objects and shall permit dynamic creation and deletion thereof.
1. Analog Input Object
 - a. Read and Write Properties: Description, Name, Value, COV Increment, Out of Service, Reliability
 - b. Read Only Properties: Type, Units, Status Flags, Event State
 2. Analog Output Object
 - a. Read and Write Properties: Description, Name, Value, Out of Service, Reliability
 - b. Read Only Properties: Type, Units, COV Increment, Status Flags, Event State, Priority Array
 3. Analog Variable Object
 - a. Read and Write Properties: Description, Name, Value, Units, COV Increment, Out of Service, Reliability
 - b. Read Only Properties: Type, Status Flags, Event State
 4. Binary Input Object
 - a. Read and Write Properties: Description, Name, Value, Out of Service, Reliability
 - b. Read Only Properties: Type, Status Flags, Event State
 5. Binary Output Object
 - a. Read and Write Properties: Description, Name, Value, Out of Service, Reliability, Minimum On/Off time
 - b. Read Only Properties: Type, Status Flags, Event State, Priority Array
 6. Binary Variable Object
 - a. Read and Write Properties: Description, Name, Value, Out of Service, Reliability
 - b. Read Only Properties: Type, Status Flags, Event State
 7. Event Enrollment Object
 - a. Read and Write Properties: Description, Name, Notification Class, Event Enable, Event Parameter, Event Type, Object Reference
 - b. Read Only Properties: Type, Event State, Event Time Stamps, Notification Type, Acknowledged Transactions
 8. Notification Class Object
 - a. Read and Write Properties: Description, Name, Priority, Recipient List
 - b. Read Only Properties: Type, Notification Class
 9. Calendar Object
 - a. Read and Write Properties: Description, Name
 - b. Read Only Properties: Type, Value
 10. Schedule Object
 - a. Read and Write Properties: Description, Name, Object Reference, Weekly Schedule, Effective Period, Schedule Exceptions
 - b. Read Only Properties: Type, Value
 11. Trendlog Object
 - a. Read and Write Properties: None
 - b. Read Only Properties: Description, Name, Type, Notification Class, Event Enable, Event State, Event Time Stamps, Notification Type, Acknowledge Transactions, Log Enabled, Start/Stop Time, Log Interval
 12. Program Object
 - a. Read and Write Properties: Description, Name, Out of Service, Reliability, Program Change
 - b. Read Only Properties: Type, Status Flags
 13. Loop Object
 - a. Read and Write Properties: Description, Name, Value, COV Increment, Out of Service, Reliability, Tuning Parameters, Action, Controlled Variable
 - b. Read Only Properties: Event State, Status Flag, Type
 14. File Object

- a. Read and Write Properties: Description, Name
- b. Read Only Properties: Type

2.02 NETWORKING COMMUNICATIONS

- A. The design of the BAS network shall integrate operator workstations and stand-alone DDC Controllers on a peer-to-peer communications network, and other devices on other networks. The network architecture shall consist of the following three levels:
 - 1. A building-wide peer-to-peer communications network between Building Controllers utilizing the BACnet protocol over Ethernet media.
 - 2. BACnet MS/TP secondary networks extended from appropriate Building Controllers to associated Advanced Application Controllers.
 - 3. Wireless communication between controllers or field devices is not permitted.
- B. Access to system data shall not be restricted by the hardware configuration of the DDC control system. The hardware configuration of the DDC system network shall be totally transparent to the user when accessing data or developing control programs.
- C. Building-wide Peer-to-Peer Communications Network:
 - 1. Operator workstations and Building Controllers shall directly reside on an Ethernet network such that communications may be executed directly between Building Controllers and workstations on a peer-to-peer basis, without requirement for any device to operate or manage the network. A portion of the network management is built into each of the peer-to-peer members. 'Peer-to-peer' refers to controllers that (when interconnected) will act independently as equals, without a network manager, and will communicate in a token passing protocol with each other to pass data packet information for the purpose of building-wide monitoring and control. A special data packet called the 'token' is constantly and continually 'passed' to every member of the peer-to-peer communications network. Any peer-to-peer device on the network can send a packet of data only when it has the 'token'. Any peer-to-peer device on this network can request data from, or send data to, any other device on the network. With this procedure, token ensures that data collisions do not occur, and assures that all members of the network get equal opportunity for all data on the network.
 - 2. Systems that operate via polled response or other types of protocols that rely on a network manager, file server, or similar device to manage panel-to-panel communications will not be considered.
 - 3. All operator devices either resident on the peer-to-peer network, or connected via dial-up modems shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the peer-to-peer network. Access to data shall be based upon logical identification of building equipment. No hardware or software limits shall be imposed on the number of devices with global access to the peer-to-peer network data.
- D. Network design shall include the following provisions:
 - 1. Provide high-speed data transfer rates for alarm reporting, quick report generation from multiple controllers and upload/download efficiency between network devices. System performance shall ensure that an alarm occurring at any DDC Controller is displayed at workstations and/or alarm printers within 5 seconds.
 - 2. Support of any combination of DDC Controllers and operator workstations directly connected to the peer-to-peer network. A minimum of 50 devices shall be supported on a single network (including MS/TP).
 - 3. Message and alarm buffering to prevent information from being lost.
 - 4. Error detection, correction and retransmission shall be included to guarantee data integrity.
 - 5. Synchronization of real-time clocks, to include automatic daylight savings time updating between all controllers shall be provided. Universal Time Coordinate based upon Greenwich Mean Time must be supported. (All BC devices must have Real Time Clocks with battery and SRAM backup, see section 1.06G).

- E. Acceptable protocols for intercommunications between building-wide peer-to-peer Building Controllers:
 - 1. BACnet/IP.
- F. Local Area (communications) Network (LAN):
 - 1. This communications network shall be limited to Building Controllers and Advanced Application Controllers and shall communicate bi-directionally with the BACnet peer-to-peer network.
 - 2. Advanced Application Controllers shall be arranged on the LAN's in a functional relationship to the corresponding Building Controllers. For example, a VAV Advanced Application Controller serving a VAV terminal box shall be connected on a MS/TP network from the Building Controller that is controlling the corresponding air handling unit.
 - 3. A maximum of 50 Advanced Application Controllers may be configured on any individual LAN from any Building Controller to insure adequate global data and alarm response times.
 - 4. Acceptable protocols for intercommunications between Advanced Application Controllers and Building Controllers on a secondary network (with the exception of lab controllers, see 2.01J-11) are as follows:
 - a. BACnet (MS/TP).
- G. Network cabling shall comply with Section 27 14 00.

2.03 BUILDING CONTROLLER

- A. DDC (stand-alone) Controllers shall have a 32 bit processor with EEPROM, flash driven operating system (OS). They shall also be multi-tasking, multi-user, real-time digital control processors and permit I/O expansion for control / monitoring of up to 48 I/O. Controller size shall be sufficient to fully meet the requirements of this specification and provide a minimum scan rate of 3 scans per second.
- B. Each Building Controller shall have sufficient flash memory (EEPROM), a minimum of 2 megabytes, to support its own operating system. In addition, there shall be additional SRAM memory for database handling, a minimum of 5 megabytes. Both the EEPROM and SRAM shall permit full implementation and support of all B-BC requirements of this specification, including:
 - 1. Control processes
 - 2. Energy management applications
 - 3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
 - 4. Historical/trend data for points specified
 - 5. Maintenance support applications
 - 6. Custom processes
 - 7. Operator I/O
 - 8. Dial-up communications
 - 9. Manual override monitoring
- C. Each Building Controller shall support:
 - 1. Monitoring of the following types of inputs, without the addition of equipment outside of the Building Controller cabinet:
 - a. Analog inputs
 - 1) 4-20 mA
 - 2) 0-10 Vdc
 - 3) Thermistors
 - b. Digital inputs
 - 1) Dry contact closure
 - 2) Pulse Accumulator
 - 3) Voltage Sensing
 - 2. Each Building Controller shall be capable of providing the following control outputs without the addition of equipment outside the Building Controller cabinet:

- a. Digital outputs (contact closure)
 - 1) Contact closure (motor starters, up to size 4)
- b. Analog outputs
 - 1) 4-20 mA
 - 2) 0-10 Vdc
 - 3) 0-135 Ohm (with external Transducer)
- D. Each Building Controller shall have a minimum of 10 percent spare (panel real estate) capacity for future point connection and shall support up to 48 I/O with modular expansion modules. All expansion modules shall be located in the building controller enclosure or an attached enclosure within line of sight of the controlled equipment. The type of spares shall be in the same proportion as the implemented I/O functions of the panel, but in no case shall there be less than two spares of each implemented I/O type. Provide all processors, power supplies, database memory, program sequence memory, and communication controllers complete so that the implementation of any added point (within the above 10% spare) only requires the addition of the appropriate point input/output termination module, point sensor, and wiring.
 - 1. Provide sufficient internal memory for the specified control sequences and have at least 25% of the memory available for future use.
 - 2. Building Controllers shall provide at least one RS-232C serial data communication ports (BACnet PTP compatible) for operation of operator I/O devices such as industry standard printers, operator terminals, modems and laptop portable operator's terminals. Building Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals. System-wide access must be provided at each mechanical equipment room through the local Building Controller. Panel mounted terminals are not required. Furthermore, all Building Controllers shall include a hardwired, concealed and secured, RJ-11 or RJ-45 jack for use by the Portable Operators Workstation. The local operator, using the Portable Operators Workstation, shall plug into this jack, and shall perform all monitoring, control, and programming of sequences for any and all building-wide points and sequences while standing at any Advanced Application Controller.
- E. As indicated in the point I/O schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the Building Controller via local, point discrete, on-board supervised hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points. These override switches shall be operable whether the panel processor is operational or not.
 - 1. Switches shall be mounted either within the Building Controller's key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.
 - 2. Building Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. Building Controllers shall also collect override activity information for reports.
- F. Building Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LED's or analog indication of value shall also be provided for each analog output.
- G. Each Building Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The Building Controller shall provide both local and remote annunciation of any detected component failures and for repeated failure to establish network communications.
- H. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with current IEEE Standard C62.41.
- I. In the event of the loss of normal power, there shall be an orderly shutdown of all Building Controllers to prevent the loss of database or operating system software. Programs residing in memory shall be protected either by using EEPROM under capacitor backup or by an

uninterruptible power source (battery backup). The backup power source shall have sufficient capacity to maintain volatile memory in event of an AC power failure. Where interruptible power source is rechargeable (a rechargeable battery), provide sufficient capacity for a minimum of seventy-two hours backup. Charging circuitry, while the controller is operating under normal line power, shall constantly charge the rechargeable power source. A non-rechargeable power source shall not be permitted. Batteries shall be implemented to allow replacement without soldering.

1. Upon restoration of normal power, the Building Controller shall automatically resume full operation without manual intervention.
 2. Should Building Controller memory be lost for any reason, the user shall have the capability of reloading the Building Controller via the local RS-232C port or from a network workstation PC.
- J. Building Controllers must comply with Section 2.03, A-I and 2.04. Panels that lose communication or control due to a single sensor failure are not permitted.
- K. Building Controllers will be used in each equipment room where major or more than two pieces of equipment are being controlled. The use of AAC or ASC devices for critical or main system equipment will not be permitted.
- L. All points associated with a given mechanical system (i.e., an air handling unit) will be controlled from a single Building Controller or point expansion panels from the respective master. (i.e., remote motor control centers). All expansion modules shall be located in the building controller enclosure or an attached enclosure within line of sight of the controlled equipment. No points from a given mechanical system may be distributed among multiple panels - points must be run back to a single Building Controller dedicated to that mechanical system. Closed-loop control must never depend upon network communications. All inputs, set points, program sequences, and outputs for any single DDC control loop shall reside in the same Building Controller. Loops shall be programmed to prevent wind up of the loop when the loop is not in use.

2.04 BUILDING CONTROLLER RESIDENT SOFTWARE FEATURES

- A. General:
1. All necessary software to form a complete operating system as described in this specification shall be provided.
 2. The software programs specified in this Section shall be provided as an integral part of Building Controllers and shall not be dependent upon any higher level computer for execution.
- B. Control Software Description:
1. The Building Controllers shall have the ability to perform any or all of the following pre-tested control algorithms:
 - a. Two-position control
 - b. Proportional control
 - c. Proportional plus integral control
 - d. Proportional, integral, plus derivative control
 2. Control software shall include a provision for limiting the number of times that each piece of equipment may be cycled within any one-hour period.
 3. The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads. This feature shall be resident in all Binary Output objects. The use of custom programming to prevent an excessive demand on start-up shall not be required.
 4. Upon the resumption of normal power, each Building Controller shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling and turn equipment on or off as necessary to resume normal operations.
- C. All programs shall be executed automatically without the need for operator intervention and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the Sequence of Operations. Building Controllers shall have the ability to perform any or all of the following energy management routines:

1. Time-of-day scheduling
 2. 365 day Calendar-based scheduling
 3. Holiday scheduling
 4. Temporary schedule overrides
 5. Start-Stop Time Optimization
 6. Automatic Daylight Savings Time Switch over
 7. Night setback control
 8. Enthalpy switch over (economizer)
 9. Peak demand limiting
 10. Temperature-compensated duty cycling
 11. Fan speed/ control
 12. Heating/cooling interlock
 13. Cold deck reset
 14. Hot deck reset
 15. Hot water reset
 16. Chilled water reset
 17. Condenser water reset
 18. Chiller sequencing
 19. Chiller load monitoring
- D. Building Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
1. It shall be possible to use any of the following in a custom process:
 - a. Any system measured point data or status.
 - b. Any calculated data.
 - c. Any results from other processes.
 - d. User-defined constants.
 - e. Arithmetic functions (+, -, *, /, square root, exponential, etc.).
 - f. Boolean logic operators (and/or, exclusive or, etc.).
 - g. On-delay/off-delay/one-shot timers.
 2. Custom processes may be triggered based on any combination of the following:
 - a. Time interval
 - b. Time-of-day
 - c. Date
 - d. Other processes
 - e. Time programming
 - f. Events (e.g., point alarms)
 3. A single process shall be able to incorporate measured or calculated data from any and all other controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other controllers on the network.
 4. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.
 5. The custom control programming feature shall be compiled and documented via English language descriptors. These descriptors (comment lines) shall be viewable from local operator I/O devices to facilitate troubleshooting.
- E. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each Building Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the Building Controllers ability to report alarms be affected by either operator activity at a PC workstation, local I/O device or communications with other panels on the network.
1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.

2. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each Building Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.
 3. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs.
 4. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.
 - a. Each Building Controller shall be capable of storing all custom alarmmessaging text for each alarm. The alarm text shall be unique and user defined; custom text shall be available for all BACnet alarms and shall reside in the BC, not in an OWS or PC.
 - b. Alarms shall have ability to be acknowledged from the local operator I/O device, (once the problem is resolved).
 5. Alarms shall be created only if they require an operator to take an action. The BAS Contractor shall submit a complete alarm list with the control system submittal package. BAS Contractor will submit a finalized alarm list in as-built documentation. The list will show the alarm Event Enrollment number, description, cause of the alarm, and diagnostic steps to resolve the alarm.
 6. All Air Handling Unit controllers shall minimally have the following alarms:
 - a. Low Limit Thermostat Alarm.
 - b. Supply Fan Status Critical.
- F. A variety of historical data collection utilities shall be provided for manual or automatic sampling, storing and displaying system data for points as specified in the I/O summary.
1. Building Controllers shall store point history data for selected analog and digital inputs and outputs:
 - a. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each Building Controller. Two methods of collection shall be allowed; either by a pre-defined time interval, or upon a pre-defined change of value. Sample intervals of 1 second to 7 days shall be provided. Each Building Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of 50,000 data samples.
 2. Trend data shall be stored at the Building Controllers and uploaded to the workstation when retrieval is desired. Uploads shall occur based upon either a user-defined interval, or a manual command, or automatically when the trend buffers are full. Furthermore, the workstation shall notify the end-user if the hard drive capacity is low or if the database size is excessive. The OWS shall use a standard MSDE or SQL database handler for all trend log management. All trend data shall be available to all BACnet OWSs and for use in 3rd party personal computer applications. File format type to be comma delineated.
 3. Building Controllers shall also provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary. Provide capability to view or print trend and tuning reports.
 - a. The Loop object shall display the most recent historical data of its own performance. It shall illustrate the number of setpoint crossings and the maximum and average deviation from setpoint.
 - b. Loop tuning shall be capable of being initiated either locally at the Building Controller or from a network workstation. For all loop tuning functions, access shall be limited to authorized personnel through password protection.

- G. Building Controllers shall automatically accumulate and store run-time hours for digital input and output points as specified in the point I/O summary.
 - 1. The totalization routine shall have a sampling resolution of one minute or less.
 - 2. The user shall have the ability to define a warning limit for run-time totalization. Unique, user-specified messages shall be generated when the limit is reached.
- H. Building Controllers shall automatically sample, calculate and store consumption totals on a daily, weekly or monthly basis for user-selected analog and digital pulse input type points as specified in the point I/O summary.
 - 1. Totalization shall provide calculation and storage of accumulations of up to 99,999.9 units (e.g., kWh, gallons, BTU, tons, etc.).
 - 2. The totalization routine shall have a sampling resolution of one minute or less.
 - 3. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.
- I. Building Controllers shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly or monthly basis for points as specified in the point I/O summary.
 - 1. The event totalization feature shall be able to store the records associated with a minimum of 9,999.9 events before reset.
 - 2. The user shall have the ability to define a warning limit. Unique, user-specified messages, up to 200 characters, shall be generated when the limit is reached.
- J. Advanced Application Controllers:
 - 1. Each Building Controller shall be able to extend its performance and capacity through the use of remote Advanced Application Controllers. Each Advanced Application Controller shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each Advanced Application Controller shall be a microprocessor-based, 32 bit, multi-tasking, real-time digital control processor. Provide for control of terminal equipment including, but not limited to, the following:
 - a. Air Handling Units
 - b. Rooftop units
 - c. VAV Boxes
 - d. Unit Heaters
 - e. Other terminal equipment or monitoring
 - 2. Advanced Application Controllers must comply with Section 2.04, items A through I, and must be peer-to-peer devices. Advanced Application Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Provide a hand/off/automatic switch for each digital output for manual override capability. Switches shall be mounted either within the controller's key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides. In addition, each switch position shall be supervised in order to inform the system that automatic control has been overridden. Switches will only be required for non-terminal applications or where controllers are readily accessible (not required for VAVs, Heat Pumps, etc. that are above ceilings or inaccessible). All inputs and outputs shall be of the Universal type, allowing for additional system flexibility. A minimum of 12 global points (i.e. chilled water temperature, hot water temperature, etc.) must be able to be accessed through the Advanced Application Controller. If global point access is unavailable with the Advanced Application then a Building Controller must be furnished.
 - 3. Each Advanced Application Controller shall support its own real-time operating system. Provide a time clock with battery backup to allow for stand-alone operation in the event that communication with its Building Controller is lost and to insure protection during power outages. In the event that the AAC does not support a real time clock (RTC) function and it is being used on critical or system level equipment as mentioned in section 2.04 J.1 then a Building Controller supporting RTC functionality shall be used in its place. AAC devices without RTC functionality will be permitted for use on terminal or unitary equipment such

as VAV boxes (except for laboratories), fan coils, heat pumps, unit ventilators and auxiliary monitoring and control.

4. Provide each Advanced Application Controller with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM under capacitor backup (lithium or rechargeable battery backup will not be permitted). Advanced Application Controllers must be fully programmable with a minimum of 200 lines of code available for custom programming. All programs shall be field-customized to meet the user's exact control strategy requirements. Advanced Application Controllers utilizing pre-packaged or canned programs shall not be acceptable. As an alternative, provide Building Controllers for all central equipment in order to meet custom control strategy requirements.
5. Programming of Advanced Application Controllers shall utilize the same language and code as used by Building Controllers to maximize system flexibility and ease of use. Should the system controller utilize a different control language, provide a Building Controller to meet the specified functionality.
6. Local alarming and trending capabilities shall be provided for convenient troubleshooting and system diagnostics. Alarm limits and trend data information shall be user-definable for any point.
7. Each controller shall have connection provisions for a portable operator's terminal. This tool shall allow the user to display, generate or modify all point databases and operating programs. All new values and programs may then be restored to EEPROM via the programming tool.
8. Advanced Application Controllers that lose communication with master panels, and/or lose control due to a single sensor failure, are not acceptable.
9. At all Advanced Application Controllers include a hardwired, concealed and secured, RJ-11 or RJ-45 jack for use by the Portable Operators Workstation. The local operator, using the Portable Operators Workstation, shall plug into this jack, and shall perform all monitoring, control, and programming of sequences for any and all building-wide points and sequences while standing at any Advanced Application Controller.
10. At all Advanced Application Controllers, include the point database of the following minimum building-wide system data:
 - a. Building Primary Hot Water Return and Supply Temperatures
 - b. Building Primary Chilled Water Return and Supply Temperatures
 - c. Building Common Outside Air Temperature
 - d. All VAV boxes shall include a discharge air sensor.

2.05 FIELD DEVICES

- A. Temperature Sensors: Each temperature sensor shall match the requirements of the associated temperature controller and shall be based upon 10-K Type-2 thermistors. Each sensor shall be designed for the appropriate application (i.e., duct, immersion, etc.) and be provided with all necessary installation accessories. Ranges shall be selected to the middle of the control range. Temperature sensors must have a minimum accuracy of ± 0.5 deg F or 0.5 % of scale; whichever will provide the least error in measurement.
 1. Electronic: A modulating solid state sensor with built-in detector, with continuous voltage or current output. Each sensor shall have individual setpoint adjustment. Input voltage shall be 24 VAC or less. Sensors shall be of matching type to the input detectors and output drives or sequencers.
 2. All room sensors shall have override pushbutton to change space to "occupied" for 2 hours during unoccupied hours. Room sensors to have temperature indication but shall not allow adjustment by the occupant; adjustment to be made through the BAS by authorized users only.
 3. Install thermostats and sensors at 4'-6" AFF to bottom unless otherwise noted on Architectural Drawings. Coordinate installation with the work of other trades before any rough-ins are made.

4. Duct Sensors: DDC duct sensors shall match the requirements of the associated controller incorporating an electrical signal to insure exact and proportional relationship between the measured variable and the transmitted signal. Static pressure sensors shall be mounted in temperature control panels with connecting sensor lines in hard copper. Where a device is used for sensing of Mixed Air Temperature or Preheat applications and the duct area is in excess of 24 square feet the instrument shall incorporate a capillary averaging element with a minimum length of 96 inches or a suitable array of duct sensors wired as a single input. Averaging sensors shall be used on any duct application where duct area exceeds 24 square feet.
 5. Provide temperature sensors as required to meet the sequence of operation; in addition, provide temperature sensors in the following locations: return air, mixed air, coil discharge air sections, and supply air temperature if not required by the sequence of operation.
 6. Wireless sensors are not permitted.
- B. Pressure Sensors: Duct static pressure analog sensors shall be high accuracy +/-1% of range suitable for the low pressures and selected for at least 50% over range. Sensors shall have industry standard 4-20 mA output and zero end span adjustments.
- C. Control Dampers (Multiple Blade Dampers): Automatic dampers furnished by the BAS Contractor shall be single blade or multiple blades as applicable. All dampers shall be sized to the application by the manufacturer using methods similar to control valve sizing. Dampers shall be installed by the HVAC Contractor under the supervision of the BAS Contractor. All dampers furnished by air handling unit manufacturers must meet the requirements listed in this section. All blank-off plates and conversions necessary to install smaller than duct size dampers are the responsibility of the HVAC Contractor. All damper frames shall be constructed of extruded aluminum hat channel with a 0.125" minimum wall thickness and shall have flanges for duct mounting. Damper blades shall not exceed 6 inches width. All blades shall be airfoil type construction and shall be equal to Ruskin RCD 50 control dampers with blade and jamb seals. Blades are to be suitable for high velocity performance. All damper bearings shall be made of molded synthetic. Bushings that turn in the bearings shall be oil impregnated sintered metal. Dampers hung with blades mounted vertically shall be provided with thrust bearings. Butyl rubber seals shall be installed along the top and bottom of the frame and neoprene along each blade edge. Independent, self-compensating, stainless steel end seals shall be installed to ensure minimum leakage between blade ends and damper frame. Seals shall provide a tight closing low leakage damper. Damper sections shall not exceed 48" in length or 16 sq. ft. Openings that require multiple damper sections shall be jack shafted together where appropriate. All dampers in modulating applications shall have opposed blades. Dampers in two-position services shall have parallel blades. Where sequence requires, submittals shall include damper sizes and leakage characteristics. Leakage shall not exceed 3 CFM/SF at 1" of static pressure and shall be AMCA licensed as a Class 1A damper.
1. Control dampers will be sized by the temperature control contractor to the inside of the duct or duct liner whichever is smaller. Sizing of dampers to duct size and the subsequent cutting back of insulation to make dampers fit is unacceptable.
 2. Control dampers used for outside air or exhaust air applications will be installed a minimum of 6" away from wall penetrations to allow for external mounting of their respective damper motors. Jack shafting in these applications will only be allowed to prevent having to mount motors in the outside airstream. When internal damper motor mounting is required the sheet metal contractor shall provide access panels at each motor location to allow for ease of service.
- D. Damper Operators: Operators shall be electronic, spring return, low voltage (24VAC), and shall be properly sized so as to stroke the damper smoothly and efficiently throughout its range. Actuator responses shall be linear in response to sensed load.
1. Electronic damper motors for terminal boxes will be provided by the temperature control contractor and shipped to the terminal box manufacturer for mounting. Mounting charges shall be the responsibility of the terminal box manufacturer.
 2. Damper operators on outside air intake/exhaust shall be spring return closed.

3. VAV Terminal Boxes using internal or proprietary actuators are unacceptable.
 4. Modulating electronic damper operators shall provide an analog position feedback signal to the system controller.
 5. Damper operators that are 2-position (i.e. open/closed) shall be provided with safety limit switches interlocked to fan motor starters to prevent equipment damage from under/over pressurization and open/closed status contacts back to the DDC controller.
- E. Automatic Control Valves:
1. All valves shall be equipped with throttling plugs and removable composition discs and shall be manufactured by Honeywell, Belimo, or Johnson Controls. All valves are to be sized by the Control Contractor and shall submit pressure drop calculations and guarantee sufficient size to meet the requirements of the equipment being served. Valve operators shall be of such design so as to provide adequate operating power for valve positioning. BLX positioners are prohibited.
 2. Reheat valves controlled by AACs in VAV terminal applications shall utilize electronic actuation and shall fail normally closed (capacitor or spring driven failsafe).
 3. Valve Construction:
 - a. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.
 - b. Hydronic Systems:
 - 1) Rate for service pressure of 125 psig at 250 degrees F.
 - 2) Replaceable plugs and seats of stainless steel.
 - 3) Size for 3 psig maximum pressure drop at design flow rate.
 - 4) All control valves to be 2-way modulating valves; except isolation valves for unit heaters shall be 2-position, line sized.
 4. Electronic Operators:
 - a. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
 - b. All reheat coil valves and chilled water coil valves shall fail closed.
 - c. Valve operators shall be 24VAC power with 0-10 VDC control signal.
- F. Air Static and Velocity Pressure Transmitter: The pressure transmitter shall be used for measuring duct static or velocity pressure in variable air volume fan systems. Location of down duct static sensors shall be provided in the as-built drawings.
- G. Low Limit Detection Thermostat: Low limit detection thermostats equal to Siemens 134-1511 shall be of the vapor tension capillary type having a sensing element a minimum of 20 feet in length. These thermostats shall be of the manual reset type. The elements shall be complete with necessary fittings to permit installation in the duct so as to sense the correct discharge temperatures. One low limit detection thermostat will be installed for every 24 square feet of protected area and arranged so as to stop their respective units and close the outside air dampers in the event discharge temperatures fall below 38 degrees F. The normally closed contact shall be wired to the fan circuit and the normally open contact (close on alarm) shall be wired to a DDC input. One common circuit is suitable for multiple thermostats on a single AHU coil area.
- H. Fan and Pump Proof: Proof points for air handling unit fans, exhaust fans and pumps will be accomplished through the use of current sensing relays at the motor control center or motor starters. Current sensing relays shall be split-core design, for installation over any single power lead. Current sensing relays shall include field adjustable set screw for amperage setpoint adjustment, and shall include integral LED status light to locally indicate the 'on' and 'off' condition. Where possible, the LED status light shall be visible outside of VFDs, cabinets, enclosures and junction boxes to allow the operator to see the status of the unit. Combination relay and current status sensors shall not be use.

2.06 LABELING

- A. Provide labels for all field devices including sensors, transducers, thermostats, and relays. Exception: Room temperature and/or humidity sensors shall not be labeled.

- B. Labels shall be black laminated plastic with white letters and adhesive backing or screw fasteners. Labels shall be located adjacent to device and permanently affixed to device mounting surface. Labels for sensors in pipes may be secured using chain around the sensor well.
- C. Labels shall include system virtual/pseudo point name as well as English language name of device being controlled or specific condition being sensed.
- D. Identify all control wiring at each end with a wire tags or labels. Label shall include object name and BACnet object reference number within 6" of cable termination.
- E. Identify and label all control transformers by indicating all devices each one powers.
- F. All 120 VAC panel power sources shall have labels in panels for electrical panel and breaker number.

2.07 POWER SUPPLIES AND LINE FILTERING

- A. Power Supplies:
 - 1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
 - 2. Limit connected loads to 80 percent of rated capacity.
 - 3. Match DC power supply to current output and voltage requirements.
 - 4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
 - 5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
 - 6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
 - 7. Operational Ambient Conditions: 32 to 120 degrees F.
 - 8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD-810 for shock and vibration.
 - 9. Line voltage units UL recognized and CSA approved.
- B. Power Line Filtering:
 - 1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
 - 2. Minimum surge protection attributes:
 - a. Dielectric strength of 1000 volts minimum.
 - b. Response time of 10 nanoseconds or less.
 - c. Transverse mode noise attenuation of 65 dB or greater.
 - d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Beginning of installation means installer accepts existing conditions.
- C. Verify that systems are ready to receive work.
- D. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices and wiring is installed prior to installation proceeding.

3.02 INSTALLATION

- A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
- B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 09 93.
- C. Provide conduit and electrical wiring in accordance with Section 26 05 83. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

- D. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

3.03 ON-SITE TESTING

- A. Field Test: When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. The installer shall complete all testing, calibrating, adjusting and final field tests. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power. Upon completion of the work, notify the Owner and/or Architect that the system is ready for final tests and inspection.
- B. At the time of final inspection, this Contractor shall be represented by a person with the proper authority, who shall demonstrate, as directed by the Architect, that his work fully complies with the purpose and intent of the Specifications and Drawings. Labor, services, instruments, and tools necessary for demonstrations and tests shall be provided by the Contractor.
- C. The Contractor shall test and adjust each instrument, specialty, and equipment furnished by him, prior to final acceptance. The Contractor shall demonstrate, for approval by the Architect, subsystems operate as a coordinated and properly functioning, integrated system including the graphics, alarms, and trending.
- D. The Contractor shall furnish labor to provide adjustments and incidentals necessary to obtain the desired and intended results.
- E. The Contractor shall turn over a printed copy and electronic copy of the completed and debugged operating software to the Owner at the conclusion of the two year warranty.

3.04 SERVICE AND GUARANTEE

- A. General Requirements: Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of two years after completion of successful performance test. Provide necessary material required for the work. Minimize impacts on facility operations when performing scheduled adjustments and non-scheduled work.
- B. Description of Work: The adjustment and repair of the system includes all computer equipment, software updates (including all firmware updates), transmission equipment and all sensors and control devices. Provide the manufacturer's required adjustments and all other work necessary.
- C. Personnel: Provide qualified personnel to accomplish all work promptly and satisfactorily. The Owner shall be advised in writing of the name of the designated service representative, and of any changes in personnel.
- D. Systems Modifications: Provide any recommendations for system modification in writing to the Owner.
 - 1. Do not make any system modifications, including operating parameters and control settings, without prior approval from the Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.
- E. Software: Provide all software updates and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and shall be incorporated into the operations and maintenance manuals, and software documentation.
- F. As-Built: Electronically submit 1 complete set of drawings to the Architect showing the kind of control equipment for each of the various systems and their functions, along with indications on the drawing of all original setpoints and calibration values, and setup parameters, and sequence of operation of the automation system together with a complete brochure describing the equipment and their functions and operation. Include all application software documentation (actual programs or their job-specific flow charts) with DDC system.
 - 1. Manufacturer's Product Data:
 - a. All equipment components.

2. Shop Drawings:
 - a. System wiring diagrams with sequence of operation for each system as specified.
 - b. Submit manufacturer's product information on all hardware items along with descriptive literature for all software programs to show compliance with specifications.
 - c. System configuration diagram showing all panel types and locations as well as communications network layout and workstations.
3. Provide one copy of the actual installed BAS program for the building on DVD or thumb drive for Owner's use as a backup.

3.05 TRAINING

- A. The Contractor shall provide competent and certified instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed rather than a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 8:00 a.m. to 4:30 p.m. weekdays as follows:
- B. Provide 16 hours of training for the Owner's operating personnel. Training shall include:
 1. Explanation of drawings, operations and maintenance manuals
 2. Walk-thru of the job to locate control components
 3. Software, peripherals and panel communication procedures.
 4. DDC Controller and ASC operation/function
 5. Operator workstation and peripherals
 6. Building Controller, Advanced Application Controller operation/function
 7. Operator control functions including graphic generation and field panel programming
 8. Operation of portable operator's terminal
 9. Explanation of adjustment, calibration and replacement procedures
- C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If the Owner requires such training, it will be contracted at a later date. Provide description of available local and factory customer training.

END OF SECTION

SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.
- B. Sequence of operation for:
 - 1. Energy Recovery Unit.
 - 2. Laboratory Exhaust Fan.
 - 3. Air Terminal Boxes.
- C. Integration of Laboratory and packaged HVAC controls with Building Automation System (BAS).

1.02 RELATED REQUIREMENTS

- A. Section 23 09 23 - Direct-Digital Control System for HVAC.
- B. Section 23 09 95 - Laboratory Airflow Control System.

1.03 SUBMITTALS

- A. Sequence of Operation Documentation: Submit written sequence of operation for entire new HVAC system and each piece of equipment.
 - 1. Preface: 1 or 2 paragraph overview narrative of the system describing its purpose, components and function.
 - 2. State each sequence in small segments and give each segment a unique number for referencing in Functional Test procedures; provide a complete description regardless of the completeness and clarity of the sequences specified in Contract Documents.
 - 3. Include at least the following sequences:
 - a. Start-up.
 - b. Normal operating mode.
 - c. Unoccupied mode.
 - d. Capacity control sequences and equipment staging.
 - e. Temperature and pressure control, such as setbacks, setups, resets, etc.
 - f. Detailed sequences for all control strategies, such as economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
 - g. Effects of power or equipment failure with all standby component functions.
 - h. Sequences for all alarms and emergency shut downs.
 - i. Seasonal operational differences and recommendations.
 - j. Interactions and interlocks with other systems.
 - 4. Include initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
 - 5. For packaged controlled equipment, include manufacturer's furnished sequence of operation amplified as required to describe the relationship between the packaged controls and the control system, indicating which points are adjustable control points and which points are only monitored.
- B. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
 - 1. Label with settings, adjustable range of control and limits.
 - 2. Include the system and component layout of all equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
 - 3. Include all monitoring, control and virtual points specified elsewhere.
 - 4. Include a key to all abbreviations.

- C. Points List: Submit list of all control points indicating at least the following for each point.
1. Point abbreviation.
 2. Point description; such as dry bulb temperature, airflow, etc.
 3. Point type consisting of one of the following:
 - a. AI: analog (continuously variable) input.
 - b. AO: analog output.
 - c. BI: binary (two position) input.
 - d. BO: binary output.
 - e. AV: analog virtual point.
 - f. BV: binary virtual point.
 4. Control point or setpoint (Yes / No); i.e. a point that controls equipment and can have its setpoint changed.
 5. Monitoring point (Yes / No); i.e. a point that does not control or contribute to the control of equipment but is used for operation, maintenance, or performance verification.
 6. Intermediate point (Yes / No); i.e. a point whose value is used to make a calculation which then controls equipment, such as space temperatures that are averaged to a virtual point to control reset.
 7. Calculated point (Yes / No); i.e. a "virtual" point generated from calculations of other point values.
- D. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CENTRAL FAN SYSTEMS

- A. Energy Recovery Unit
1. See Sequence of Operation and Point List on the Drawings.

3.02 LABORATORY VENTILATION SYSTEM

- A. Run Conditions
1. Laboratory Exhaust Fan shall run 24 hours per day, 7 days per week.
- B. Laboratory Airflow Controls
1. Laboratory airflow controls will be furnished and controlled under Section 23 09 95 by the Temperature Control Subcontractor. The laboratory airflow controls Subcontractor shall provide the following alarms in BACnet protocol for the BAS system to receive and process for alarming and display purposes:
 - a. Laboratory High Temperature Alarm.
 - b. Laboratory Low Temperature Alarm.
 - c. Hood Failure Alarm.
 2. The above alarms are general and require physical access to the Laboratory Airflow System controller to determine particular rooms and hoods affected.

3.03 AIR TERMINAL UNITS

- A. Run Conditions
1. Unit shall run according to a User-defined time schedule in the following modes:
 - a. Occupied Mode
 - 1) 72 degree F (adjustable) cooling setpoint.
 - 2) 71 degree F (adjustable) heating setpoint.
 - b. Unoccupied Mode (night setback)
 - 1) 76 degree F (adjustable) cooling setpoint.
 - 2) 66 degree F (adjustable) heating setpoint.
 - c. Morning Start-up
 - 1) Setpoints to be the same as Occupied setpoints.

2. If any zone temperature is greater than the cooling setpoint by 5 degrees F (adjustable), issue a "High Zone Temperature" alarm.
 3. If any zone temperature is less than the heating setpoint by 5 degrees F (adjustable), issue a "Low Zone Temperature" alarm.
 4. The room occupant shall have no ability to adjust setpoints. All adjustments must be made through the BAS or DDC systems by authorized personnel.
 5. A pushbutton at the room temperature sensor shall activate a timed override interval of 3 hours (adjustable) duration during which the unit will go to Occupied Mode regardless of schedule. At the expiration of the override interval, the unit shall revert to normally scheduled Mode.
- B. Air damper shall be set for minimum and maximum cooling flows noted on the Drawings. Heating CFM shall equal cooling minimum CFM.
- C. Occupied Mode
1. When zone temperature is greater than cooling setpoint, the zone damper shall modulate between minimum flow and maximum flow until the zone is satisfied.
 2. When zone temperature is between the cooling setpoint and the heating setpoint, the zone damper shall maintain the minimum flow.
 3. When zone temperature is less than heating setpoint, the air damper shall be at cooling minimum CFM and the reheat coil valve shall modulate open until the zone is satisfied.
- D. Unoccupied Mode
1. The zone damper shall maintain minimum airflow.
 2. When zone temperature is greater than cooling setpoint, the zone damper shall modulate between minimum flow and maximum flow until the zone is satisfied.
 3. When zone temperature is less than heating setpoint, the air damper shall be at cooling minimum CFM and the reheat coil valve shall modulate open until the zone is satisfied.
- E. Provide inputs and outputs from each terminal unit according to the following schedule:

Point Name	Point Type	Trend	Alarm	Show on Graphic
Zone Temperature	AI	X		X
Actual Airflow	AI			X
Discharge Air Temperature	AI	X		X
Zone Damper Control	AO	X		X
Reheat Coil Valve Control	AO	X		X
Zone Override	BI	X		X
Airflow Setpoint	AV	X		X
Heating Mode	BV			
Heating Setpoint	AV	X		X
Cooling Setpoint	AV	X		X
High Zone Temperature	Alarm		X	X
Low Zone Temperature	Alarm		X	X

END OF SECTION

SECTION 23 09 95 - LABORATORY AIRFLOW CONTROL SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. A Laboratory Airflow Control System (LACS) shall be furnished and installed under this section to control the airflow into and out of critical laboratory spaces. The LACS shall vary the amount of make-up/supply air into each room to operate the spaces at the lowest possible airflow rates necessary to maintain temperature control, achieve minimum ventilation rates and maintain room pressurization in relation to adjacent spaces (positive or negative). The LACS shall be capable of operating as a standalone system or as a system integrated with the Building Automation System (BAS).
- B. Room pressurization controllers.
- C. Fume hood controllers.
- D. Supply airflow control valves.
- E. Exhaust airflow control valves.

1.02 ABBREVIATIONS AND ACRONYMS

- A. ATC – Advanced Temperature Control
- B. BAS – Building Automation System
- C. LACS – Laboratory Airflow Control System
- D. VAV – Variable Air Volume

1.03 REFERENCE STANDARDS

- A. AHRI 880 - Performance Rating of Air Terminals; 2017.
- B. ANSI/ASHRAE 130 - Laboratory Methods of Testing Air Terminal Units; 2016.
- C. ANSI/ASHRAE 135 - BACnet: A Data Communication Protocol for Building Automation and Control Network; 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: The LACS representative shall coordinate all details of the installation with the successful mechanical contractor. This effort shall include complete coordination of the sheet metal layout drawings to assure that the ductwork layout and sizing is based on the actual sizes of the airflow control valves for this project.
- B. Pre-installation Meetings
 - 1. The LACS representative shall review the proper installation of the system with the sheet metal contractor, the DDC System contractor, and the building management system (BMS) contractor.
 - 2. Project Installation Phase – The LACS representative shall make periodic visits to the project jobsite to assure that the system is being installed properly to assure optimal performance and that the location and orientation of the control valves is consistent for proper operation and future Owner maintenance. Any discrepancies shall first be brought to the attention of the appropriate subcontractor. If no action is taken by said contractor, the representative shall bring these issues to the project manager, engineer or owner's representative for resolution.

1.05 SUBMITTALS

- A. General: Submit listed Submittals in accordance with Conditions of the General Contract and Division 1 Submittal Procedures Section. LACS submittals shall contain, at a minimum, the following information:
 - 1. Product Data Sheets.
 - 2. Equipment Schedule Sheets containing Room#, Tag#, Min/Max flows, Catalog# and other configuration data as required to provide a fully engineered LACS.
 - 3. Installation Instructions.

4. Project-specific Wiring Diagrams.
 5. Points List.
 6. Sequences of Operation.
 7. System configuration diagram showing all control panel types and locations.
- B. Closeout Submittals
1. Operation and maintenance manuals, including as-built wiring diagrams and component lists, shall be provided as closeout submittals.

1.06 QUALITY ASSURANCE

- A. Certifications: The laboratory airflow system provider shall be an entity that designs, develops, manufactures and sells products and services to control the environment and airflow of critical spaces using a Quality Management System registered to ISO 9001:2008.
- B. The Venturi valves shall be calibrated on NVLAP accredited air stations.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements
1. Prior to installation, the LACS shall be stored in dry conditions within an environment complying with LACS product specifications as shown on product data sheets within the submittals.
 2. The LACS products shall be handled and transported in a manner consistent trade practices for control systems and instruments.

1.08 FIELD CONDITIONS

- A. The ambient environmental conditions during installation and operation shall comply with LACS product specifications as shown on the product data sheets within the submittals.

1.09 WARRANTY

- A. The Warranty shall commence upon the date of shipment and extend for a period of 60 months for all airflow control devices and 36 months for all other control system components.
- B. Contractor shall complete and submit all warranty registration forms.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The plans and specifications for the LACS are based on systems and equipment manufactured by Antec Controls. Equal products conforming to all aspects of this Specification Section may be provided by Phoenix Controls.
- B. Substitutions:
1. In strict accordance with this specification, substitute LACS and equipment shall only be considered for approval provided that the equipment be equal in every respect to the operational characteristics, capacities and intent of control sequences specified herein. Approval to bid does not relieve the LACS supplier from complying with the minimum requirements or intent of this specification.
 2. The engineer and owner shall be the sole judges of quality and equivalence of equipment, materials, methods and life cycle cost.
 3. Any substitute LACS supplier shall provide a separate compliance schedule, which shall include the section, paragraph and subparagraph of these specifications, and a direct statement to indicate compliance or noncompliance with the requirements. For all areas of noncompliance, the supplier shall describe what specific and alternative approach or approaches has been taken and document the impact this will have on the sizing of the air delivery systems, the required cooling and heating capacities, energy costs and maintenance of the building.
 4. The substitute LACS supplier shall furnish a letter of compliance to the engineer, signed by a corporate officer of the laboratory system manufacturer, certifying the compliance and noncompliance items as stated above 10 days prior to the bid.

5. The substitute LACS supplier shall provide a detailed proposal describing all elements of the laboratory control system. A schematic laboratory layout shall be provided, showing relations of these elements and a description of how they interact. Technical specification data sheets shall be provided for all proposed system components and devices. All proposed airflow control devices shall include discharge, exhaust and radiated sound power level performance obtained from testing in accordance with ARI Standard 880.
 - a. The LACS provider shall have in excess of 5 years experience with startup and support of equipment that they are installing. Startup personnel shall be factory certified by the LACS equipment manufacturer. If 3rd party startup is used, the 3rd party is expected to be trained at the LACS manufacturers facility.
 - b. The LACS supplier shall provide at no additional cost to the owner during and after the warranty period five years of required preventive maintenance on all airflow sensors (e.g., pitot tube, flow cross, orifice ring, air bar, hot wire, vortex shedder, etc.) and flow transducers provided under this section. Airflow sensors shall be removed, inspected, and cleaned annually during the five-year period to prevent inaccuracies due to long-term buildup from corrosion, lab tissues, wet or sticky particles, or other materials that foul the sensor. If impractical to remove the airflow sensors, the LACS supplier shall include in the proposal the cost of supplying and installing duct access doors, one for each sensor. The transducer shall be checked and recalibrated annually to ensure long-term accuracy. Note that auto-zero recalibration of transducers is not acceptable as a substitute for annual recalibration.
 - c. The LACS supplier shall provide the total system cost of proposed equal to Phoenix Controls system. This will include:
 - 1) Cost to commission the equipment
 - 2) Cost to integrate the components to the BAS system

2.02 SYSTEM DESCRIPTION

- A. Each laboratory space as defined in the control diagrams on the drawings shall have a dedicated LACS. Each dedicated LACS shall support a minimum of 20 network controlled airflow devices.
- B. The LACS shall use volumetric offset control to maintain room pressurization. The system shall maintain proper room pressurization polarity (negative or positive) regardless of any change in room/system conditions, such as the raising and lowering of any or all fume hood sashes or rapid changes in duct static pressure. Systems using differential pressure measurement, vortex shedding measurement, or velocity measurement to control room pressurization are unacceptable.
- C. Airflow Control Sound Specification
 1. The LACS manufacturer shall provide comprehensive sound power level data for each size airflow control device. All data shall be obtained from testing in accordance with ASHRAE/ANSI Standard 130, Methods of Testing Air Terminal Units.
 2. All proposed airflow control devices shall include discharge, exhaust and radiated sound power level performance.
 3. If the airflow control device cannot meet the sound power levels required to achieve the sound criteria appropriate for the space, as determined by the engineer, a properly sized sound attenuator must be used. All sound attenuators must be of a packless design (constructed of at least 18 gauge 316L stainless steel when used with fume hood exhaust) with a maximum pressure drop at the device's maximum rated flow rate not to exceed 0.20 inches of water.
- D. In the event of a power failure, airflow control devices shall fail to the last position and continue to maintain flow control within $\pm 5\%$ of signal within one second of a change in duct static pressure.

2.03 AIRFLOW CONTROL DEVICE - GENERAL

- A. The airflow control device shall be an Antec Controls pressure independent venturi valve.

- B. The valve assembly manufacturer's Quality Management System shall be registered to ISO 9001:2008.
- C. Airflow control device shall be OSHPD tested and certified per 2013 CBC, 2012, IBC, ASCE 7-10, and ICC-ES-AC-156.
- D. The airflow control device shall be pressure independent over its specified differential static pressure operating range. An integral pressure independent assembly shall respond and maintain specific airflow within one second of a change in duct static pressure irrespective of the magnitude of pressure and/or flow change (from 0.6" wg to 3.0" wg) or quantity of airflow controllers on a manifolded system.
- E. The airflow control device shall maintain accuracy within $\pm 5\%$ of signal to setpoint over an airflow turndown range of no less than 12.5 to 1.
- F. No minimum entrance or exit duct diameters shall be required to ensure accuracy and/or pressure independence.
- G. No rotational/axial orientation requirements shall be required to ensure accuracy and/or pressure independence.
- H. The airflow control device shall maintain pressure independence regardless of loss of power. "Electronically pressure independent" devices will not be acceptable.
- I. Airflow control devices utilizing ASHRAE 130 minimum operating pressure as a rating for minimum design pressure at required flow will not be an acceptable basis of minimum operating pressure alone. Valve manufacturer will provide minimum required differential pressure in writing for each size valve they offer.
- J. Airflow control device shall be able to achieve its maximum turndown ratio at its stated minimum operating differential pressure. I.E. if minimum operating pressure is 0.6" wc dp, a 10" air valve must be able to achieve its minimum of 50cfm and its maximum of 1000 cfm at stated 0.6" wc dp. Devices that require duct static pressure to be increased to achieve maximum flow shall not be acceptable.
- K. The airflow control device shall be constructed of one of the following types:
 - 1. Class A—The airflow control device for non-corrosive airstreams, such as supply and general exhaust, shall be constructed of 16-gauge aluminum. The device's shaft and internal "S" link shall be made of 316 stainless steel. The shaft support brackets shall be made of galvaneal (non shutoff valves) or 316 stainless steel (shutoff valves). The pivot arm shall be made of aluminum (for non shutoff valves) and 303/304 stainless (for shut off valves). The pressure independent springs shall be a spring-grade stainless steel. All shaft bearing surfaces shall be made of a PP (polypropylene) or PPS (polyphenylene sulfide) composite. Sound attenuating devices used in conjunction with general exhaust or supply airflow control devices shall be constructed using 24 gauge galvanized steel or other suitable material used in standard duct construction. No sound absorptive materials of any kind shall be used.
 - 2. Class B—The airflow control device for corrosive airstreams, such as fume hoods, shall have a baked-on, corrosion-resistant phenolic coating. The device's shaft shall be made of 316 stainless steel with a Teflon coating. The shaft support brackets shall be made of 316 stainless steel. The pivot arm and internal "S" link shall be made of 316 or 303 stainless steel. The pressure independent springs shall be a spring-grade stainless steel. The internal nuts, bolts and rivets shall be stainless steel. All shaft bearing surfaces shall be made of PP (polypropylene) or PPS (polyphenylene sulfide) composite.
- L. Actuation
 - 1. For high speed electrically actuated VAV operation, a CE certified, UL Listed, IP56 rated for dust and water, electronic actuator shall be factory mounted to the valve. Loss of main power shall cause the valve to position itself in an appropriate failsafe state. Options for these failsafe states include: normally open-maximum position, normally closed-minimum position and fail-to-last position. This position shall be maintained constantly without

external influence, regardless of external conditions on the valve (within product specifications).

- a. In fail safe conditions the Airflow Control Device must remain pressure independent and in control of airflow at its failed position. I.E. if a device fails in position at 500 cfm, the airflow control device must remain pressure independent regardless of having power/controller operating and will deliver the 500cfm at that given control point regardless of duct pressure. Airflow control devices with single or dual blades that fail in position or fail open will not be acceptable as the airflow delivered cannot be guaranteed due to device not being mechanically pressure independent.
 - b. During normal operation the high speed actuated airflow control device shall initiate valve movement and achieve the commanded airflow value with no more than 5% overshoot or undershoot within 1 second or less.
2. For Standard Speed electrically actuated VAV operation, a CSA certified, UL recognized electronic actuator shall be factory mounted to the valve. The failsafe state for standard speed operation valves shall be fail to last position unless otherwise noted.
 - a. During normal operation the standard speed actuated airflow control device shall initiate valve movement and achieve the commanded airflow value with no more than 5% overshoot or undershoot within 60 seconds.
 - b. Standard speed actuation should NOT be used for valves that are connected to VAV fume hoods.
 - c. Constant volume valves do not require actuators but do require flow feedback for BAS integration.
- M. The controller for the airflow control devices shall be microprocessor based and operate using peer-to-peer control architecture. The room-level airflow control devices shall function as a standalone network. The room-level control network shall utilize a LonTalk communications protocol.
- N. There shall be no reliance on external or building-level control devices to perform room-level control functions. Each laboratory control system shall have the capability of performing fume hood control, pressurization control, standard and advanced temperature control, humidity control, and implement occupancy and emergency mode control schemes. A Room controller or PLC performing these functions shall not be acceptable.
- O. NVLAP Accreditation (Lab Code 200992-0)
1. Each airflow control device shall be factory characterized on air stations NVLAP Accredited (a program administered by NIST) to ISO/IEC 17025:2005 standards.
 2. Each airflow control device shall be factory characterized to the job specific airflows as detailed on the plans and specifications using NVLAP Accredited air stations and instrumentation having a combined accuracy of no more than $\pm 1\%$ of signal (5,000 to 250cfm), $\pm 2\%$ of signal (249 to 100cfm) and $\pm 3\%$ of signal (199 to 35cfm). Electronic airflow control devices shall be further characterized and their accuracy verified to $\pm 5\%$ of signal at a minimum of 48 different airflows across the full operating range of the device.
 3. Each airflow control device shall be marked with device-specific factory characterization data. At a minimum, it should include the room number, tag number, serial number, model number, eight-point characterization information (for electronic devices), date of manufacture and quality control inspection numbers. All information shall be stored by the manufacturer for use with as-built documentation. Characterization data shall be stored indefinitely by the manufacturer and backed up off site for catastrophic event recovery.
- P. Airflow control devices that are not venturi valves and are airflow measuring devices (e.g., pitot tube, flow cross, air bar, orifice ring, vortex shedder, etc.) shall NOT be acceptable. No damper blade valves will be acceptable either.

2.04 CONSTANT VOLUME AIRFLOW CONTROL DEVICE

- A. The airflow control device shall maintain a constant airflow set point. It shall be factory characterized and set for the desired airflow. It shall also be capable of field adjustment for

future changes in desired airflow. Constant volume valves must be 100% mechanically pressure independent.

2.05 FUME HOOD DISPLAY

- A. The display screen shall be a 3.2" (diagonal) color LCD resistive touch screen (240 x 320 RGB).
- B. The touch screen shall support input configurations for fume hood operational parameters done at the touch panel and at a minimum including:
 - 1. Sash Dimensions
 - 2. Hood ID
 - 3. Hood Certification Reminder
 - 4. Hood Occupancy Status
 - 5. Stopwatch/Timer
 - 6. Message Display
- C. Hood configuration for the following properties shall be viewable and editable from the touch display:
 - 1. Sash Dimensions
 - 2. Hood ID
 - 3. Hood Certification Reminder
 - 4. Hood Occupancy Status
 - 5. Stopwatch/Timer
 - 6. Message Display
- D. The enclosure shall be made from material that is resistant to chemicals that are typically used in the lab for wipe down with non-solvent cleaning agents.
- E. One mechanical membrane button shall be provided at the front panel of the display to enable users to quickly mute alarms without having to remove protective gloves.
- F. Flush mount or recess mount shall be installation options.
- G. A USB port shall be provided to support firmware and software upgrades and shall be covered to protect against moisture or corrosion.
- H. A timer feature shall be provided to enable users to set specific durations for experiments and provide visual and audible alarms when the set time is expired.
- I. The fume hood display shall have an available I/O at its associated valve controller which may be used to receive a 0 – 10 volt signal from a Through-The-Wall (TTW) sensor. The TTW shall not control the valve but provide a drift alert to indicate when the TTW sensor reading is out of range relative to the sash position face velocity value.
- J. The device shall be powered by 24 VAC + 15% at 10VA, 50/60 Hz.
- K. **CONFIGURATION**
 - 1. Configuration shall be performed from the touch display and/or manufacturer's software tools.
 - 2. The device shall be capable of being added to an existing LON communication network.
 - 3. The device shall display fume hood performance data based on control logics embedded inside the valve controller.
- L. **COMMUNICATION**
 - 1. The fume hood display unit shall connect to LON communication and link directly to a specific valve controller associated with the hood it is mounted on.
- M. **INFORMATION DISPLAY**
 - 1. The device shall have the ability to indicate when the fume hood face velocity is within the normal operating range as well as energy saving, hood certification, hood ID, timer, and hood occupancy status.
 - 2. The device shall be configurable to display one of the following measurement units: cubic feet per minute (CFM), meters cubed per hour (m³/h), liters per second (l/s), feet per minute (fpm), or meters per second (m/s).

3. The device shall have the ability to display system errors caused by the airflow valve or sash travel.
4. The device shall have the ability to indicate to users when the hood is due for recertification by stating on the LCD display "Hood Cert. due MM/DD/YYYY".

N. ALARMS

1. The device shall have the ability to show alarms on the main screen using visual and audible alerts.
2. The main screen background color shall change to flashing red with text stating the type of alarm.
3. In alarm state, the visual indication shall remain active until the event that triggered the alarm is removed or fixed.
4. The audible alarm tone shall be cleared only when the event that triggered the alarm is removed or fixed.
5. The device shall have an Alarm Muting option, which silences the audible alarm for an adjustable time period when the mute button is pushed. If another alarm is generated during the mute period, the new alarm shall override the mute delay and the alarm shall sound again.
6. The device shall have the ability to have customizable audible alarms levels and customizable mute duration.
7. Users shall have the ability to change the volume of the alarm tone to low, medium, or high.

O. SECURITY

1. End users shall have the ability to enable a PIN pass code to prevent unauthorized changes to sash heights, air flow settings and other editable parameters.

P. COMPLIANCE

1. The unit shall be certified as meeting regulatory compliance with CE, CUL, and RoHS.
2. The unit shall be suitable for use with non-solvent wipe down and is designed to meet IP44 test standards.
3. The device shall comply with part 15 of the FCC Rules. Operation is subject to the following two conditions:
4. This device shall not cause harmful interference.
5. This device shall accept any interference received, including interference that may cause undesired operation.

Q. ENVIRONMENT

1. The operating temperature range shall be between 32 – 122°F (0 – 50°C).

2.06 OPERATION SEQUENCES

- A. The airflow control devices shall utilize peer-to-peer, distributed control architecture to perform room-level control functions. Master-slave control schemes shall not be acceptable. Control functions shall include, at a minimum, volumetric offset pressurization, temperature, humidity control, as well as respond to hood flow demands, occupancy, and emergency control commands.
- B. Volumetric Offset Pressurization Control
 1. The laboratory control system shall control supply and auxiliary exhaust airflow devices in order to maintain a volumetric offset (either positive or negative). Offset shall be maintained regardless of any change in flow or static pressure (within specified range for medium or low pressure valves). This offset shall be field adjustable and represents the volume of air, which will enter (or exit) the room from the corridor or adjacent spaces.
 2. All air valves on this project shall be constant volume. Airflow of fume hood exhaust, supply, and general exhaust valves have been calculated to maintain a specific negative offset with respect to the corridor, and to maintain minimum airflow of 10 air changes per hour in the laboratory..

3. Volumetric offset shall be the only acceptable means of controlling room pressurization. Systems that rely on differential pressure as a means of control shall provide documentation to demonstrate that space pressurization can be maintained if fume hood sashes are changed at the same time a door to the space is opened.
- C. Temperature Control
 1. Standard Primary Temperature Control
 - a. The laboratory control system shall regulate the space temperature through control of reheat coils and/or auxiliary temperature control devices. The laboratory control system shall support up to four separate temperature zones for each pressurization zone. Each zone shall have provisions for monitoring up to five temperature inputs and calculating a straight-line average to be used for control purposes. Separate cooling and heating set points shall be writeable from the BMS, with the option of a local offset adjustment.
 - b. Temperature control shall be implemented through the use of independent primary cooling and heating control functions. Primary temperature control shall be provided through modulating control of a properly sized reheat coil.
- D. Local Alarm Control
 1. The laboratory control system shall provide the means of summing selective alarm activity at the room-level network and generating a local alarm signal. The local alarm signal may be directed to any available output, as well as to the BMS. The alarm mask may be configured differently for each room-level system.
- E. Fume Hood Control
 1. Airflow devices intended to control the face velocity of a fume hood shall have the ability to interface directly with the fume hood monitoring device. The airflow control device shall:
 - a. Provide a flow feedback signal to the fume hood monitor, which may be used for calculating face velocity or to confirm the airflow device has achieved the proper flow rate and make this value available to the BMS.
 - b. Provide alarm signals to the fume hood monitor in the event the airflow device is unable to achieve the proper flow rate, there is a loss of static pressure indicating improper fan operation, or there is a loss of power to the airflow control device, in order to provide a local alarm indication.
 2. The laboratory control system shall be segregated into subnets to isolate network communications to ensure room-level control functions and BMS communications are carried out reliably. Each laboratory space or pressurization zone shall be on a single subnet. Antec Controls supplied Room Controllers or Room Integrators shall be used to isolate the subnets in a facility where BMS or BAS system is used, providing a maximum of 20 valve devices and 10 fumehood monitor per subnet.
 3. The LACS shall support at least 20 networked valve devices and 10 fume hood displays in each pressurized zone.
 4. All points shall be available through the interface to the BMS for trending, archiving, graphics, alarm notification and status reports. LACS performance (speed, stability and accuracy) shall be unaffected by the quantity of points being monitored, processed or controlled.
 5. Refer to the BMS or BAS specification for the required input/output summary for the necessary points to be monitored and/or controlled.

2.07 INTERFACE TO BUILDING MANAGEMENT SYSTEMS

- A. The LACS network shall have the capability of digitally interfacing with the BACnet IP BMS. The required software interface drivers shall be developed and housed in one or more dedicated interface devices furnished by the LACS supplier.
- B. All room-level points shall be available to the BMS for monitoring or trending. The LACS Room Controller and Room Integrator, shall maintain a cache of all points to be monitored by the BMS. The room-level airflow control devices shall update this cache continually.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The DDC System contractor shall install the fume hood monitor on the fume hood under initial supervision of the LACS supplier.
- B. The DDC System contractor shall install all Room Controllers and Room Integrators in an accessible location in or around the designated laboratory room.
- C. The DDC System contractor shall install an appropriately sized and fused 24 VAC transformer suitable for NEC Class II wiring.
- D. All cable shall be furnished and installed by the DDC System contractor. The DDC System contractor shall terminate and connect all cables as required. The DDC System contractor shall utilize cables specifically recommended by the laboratory airflow controls supplier.
- E. The mechanical contractor shall install all airflow control devices in the ductwork and shall connect all airflow control valve linkages.
- F. The mechanical contractor shall provide and install all reheat coils, Neutralizers, Silencers, and transitions.
- G. The mechanical contractor shall provide and install insulation as required.
- H. Each pressurization zone shall have either a dedicated, single-phase primary circuit or a secondary circuit disconnect.

3.02 SYSTEM STARTUP

- A. System start-up shall be provided by a factory-authorized representative of the LACS manufacturer. Start-up shall include calibrating the fume hood monitor. Start-up shall also provide electronic verification of airflow (fume hood exhaust, supply, make-up, general exhaust or return), system programming and support for integration to BMS.
- B. The balancing contractor shall be responsible for final verification and reporting of all airflows. For all field flow measurement devices the balancer shall produce a flow report that documents field flows vs device flow and associated error. This to be tabulated for each device location at several flows including min and max.

3.03 CLOSEOUT ACTIVITIES

- A. Training
 - 1. The LACS supplier shall furnish a minimum of eight hours of owner training by factory trained and certified personnel. The training will provide an overview of the job specific airflow control components, verification of initial fume hood monitor calibration, general procedures for verifying airflows of air valves and general troubleshooting procedures.
 - 2. Operation and maintenance manuals, including as-built wiring diagrams and component lists, shall be provided for each training attendee.

END OF SECTION

SECTION 23 21 13 - HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe, pipe fittings, and hangers for:
 - 1. Reheat water piping system
 - 2. Heating water piping system.
 - 3. Chilled water piping system.
 - 4. Condensate drains for cooling coils
 - 5. Equipment drains and overflows.
- B. Unions, flanges, mechanical couplings, and dielectric connections.
- C. Valves:
 - 1. Ball valves.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 53 - Identification for HVAC Piping and Equipment.
- B. Section 23 07 19 - HVAC Piping Insulation.
- C. Section 23 21 14 - Hydronic Specialties.
- D. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

- A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
- E. ASME B31.9 - Building Services Piping; 2014.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.
- H. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- I. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.
- J. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).
- K. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
- L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- M. ICC-ES #AC 193: Cracked Concrete Anchors - post-installed 2007.
- N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- B. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

1.05 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide

necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

- B. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- C. Use non-conducting dielectric connections whenever jointing dissimilar metals.
- D. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.
- E. Use ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- F. Use globe valves for throttling, bypass, or manual flow control services.
- G. Use 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
- H. All valves of a particular type furnished for this project shall be products of one manufacturer only.

1.06 SUBMITTALS

- A. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
- B. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.
- C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- D. Project Record Documents: Record actual locations of valves.
- E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
- B. Date stamp all castings used for coupling housings, fittings, valve bodies, etc. for quality assurance and traceability.
- C. Welder Qualifications: Certify in accordance with ASME BPVC-IX.

1.08 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 code for installation of piping system.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

- A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
- B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:
 - 1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
 - 2. Use non-conducting dielectric connections whenever jointing dissimilar metals.

3. Grooved mechanical joints are not permitted in any location.
 4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
- C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
- D. Valves:
1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch ball valves with cap and chain.
 2. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.
- E. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 HEATING WATER PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A 53/A 53M, Type E, Schedule 40, black, using one of the following joint types:
1. Welded Joints (2-1/2" or larger): ASTM A 234/A 234M, wrought steel welding type fittings; AWS D1.1 welded. Use long radius elbows.
 2. Threaded Joints (2" or smaller): ASTM B 16.3, malleable iron fittings. Use long radius elbows.
 3. Press fittings conforming to ASME A420 or ASME B16.3 and performance requirements of IAPMO PS 117. Press fittings shall have factory installed EPDM sealing element and an identification feature on the fitting that provides a visual indication of fittings that have NOT been pressed. Installers of the press fittings shall be certified by the manufacturer.
- B. Copper Tube (4" or smaller): ASTM B 88 (ASTM B 88M), Type L (B), drawn, using one of the following joint types:
1. Solder or Brazed Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
 - a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
 - b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
 2. Press fittings made of bronze or copper conforming to ASME B16.18 or ASME B16.22 and performance requirements of IAPMO PS 117. Press fittings shall have factory installed EPDM sealing element and an identification feature on the fitting that provides a visual indication of fittings that have NOT been pressed. Installers of the press fittings shall be certified by the manufacturer.

2.03 CONDENSATE DRAINS FOR COOLING COILS

- A. PVC Pipe: ASTM D 1785, Schedule 40, or ASTM D 2241, SDR 21 or 26.
1. Fittings: ASTM D 2466 or D2467, PVC.
 2. Joints: Solvent welded.
 3. Minimum pipe size: 1".
- B. Copper Tube: ASTM B 88 (ASTM B 88M), Type L, drawn.
1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
 2. Joints: Solder, lead free, ASTM B 32, HB alloy (95-5 tin-antimony), or tin and silver.
 3. Mechanical Joints: Copper Crimp Press Fittings.
 - a. Manufacturers
 - 1) Viega: www.viega.net
 - 2) Nibco: www.nibco.com
 - 3) Elkhart: www.elkhartproducts.com
 - b. Materials: Copper press fittings (1/2" to 4" hard copper tubing) shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22, conform to NSF 61 for potable water systems, and have elastomeric EPDM seals. The press fitting connections shall be compatible with seamless K and L hard copper tube made to

ASTM B 88, and shall be rated for a temperature range of -20°F to +220°F and a maximum non-shock working pressure of 200 PSI.

- c. Installation: All fittings shall be installed in accordance with the manufacturer's installation instructions, and according to local codes and specification requirements. Each copper press joint shall be made with pressing tools and jaw sets recommended and authorized by the manufacturer. All fittings, valves and tools shall be provided by the same manufacturer. Installers shall be trained and approved by the manufacturer.
 - d. Testing and cleaning: follow manufacturer's instructions and recommendations, and specification requirements.
 - e. Warranty: 50 years.
4. Minimum pipe size: 1".

2.04 EQUIPMENT DRAINS AND OVERFLOWS

- A. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
 - 1. Fittings: ASTM D2466 or D2467, PVC.
 - 2. Joints: Solvent welded in accordance with ASTM D2855.

2.05 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
- B. Manufacturers
 - 1. Pipe Hangers
 - a. PHD Manufacturing: www.phd-mfg.com
 - b. Empire Industries: www.empireindustries.com
 - c. B-Line: www.b-line.com
 - d. Basic-PSA, Inc: www.basicpsa.com
 - e. Unistrut: www.unistrut.com
 - 2. Concrete Anchors
 - a. ITW Red Head: www.itwredhead.com
 - b. Marksmen Manufacturing Corp: www.marksmenmfg.com
 - c. Simpson: www.simpsonanchors.com
 - d. Powers Fasteners: www.powers.com
- C. Conform to ASME B31.9.
- D. Hangers for Horizontal Pipe Sizes 1/2 to 1-1/2 Inch: Carbon steel, adjustable, clevis. Size for outside diameter of pipe insulation.
- E. Hangers for Horizontal Hot Pipe Sizes 2 inches and Over: Cast iron pipe roller; carbon steel frame, axle, and hex nuts; adjustable. Size for outside diameter of pipe insulation.
- F. Hangers for Hot Pipe Sizes 6 Inches and Greater: Adjustable steel yoke, cast iron roll, double hanger.
- G. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods, similar to Unistrut P-1000 series (type to be determined by Contractor based on total weight of piping and fluids).
 - 1. Clamp pipes to trapeze with inverted-"U" hold-down clamp, cushioned, similar to Unistrut Fig. P-2024 thru P-2070 with "Cush-a-Clamp".
- H. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.
- I. Wall Support for Pipe Sizes to 3 Inches: Split ring hanger with 3/8" minimum hanger rod and wall flange.
 - 1. Split-ring to be copper-plated or PVC-coated for use on bare copper piping.
- J. Vertical Support: Steel riser clamp (similar to PHD Fig. 550 or 553).

1. Clamp to be copper-plated or PVC-coated for use on bare copper piping (similar to PHD Fig. 552 or 554).
- K. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- L. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- M. Copper Pipe Support: Carbon steel ring, adjustable.
 1. Support on uninsulated copper pipe to be copper-plated.
- N. Hanger Rods: Threaded ASTM A107 hot rolled carbon steel threaded both ends, threaded one end, or continuous threaded.
- O. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
- P. Shields: Provide metal shields similar to PHD Fig. 170 at all support points on insulated piping. Shields to be low carbon steel with galvanized finish, 12" long, sized for outside diameter of pipe insulation.
- Q. Structural Attachment
 1. Steel Beams: Provide PHD Fig. 610 beam clamps with Fig. 35 eye nut for all supports from steel beams.
 2. Steel Bar Joists: Provide PHD Fig 250 "C" clamp with Fig. 259 retaining clip for all supports from steel bar joists. "C" clamps without retaining clips are prohibited.
 3. Wood Structure: Provide side beam bracket PHD Fig. 908 supported by thru bolt with washer and locknut. Attachment location on wood structure to be approved by the Architect.
 4. Concrete: Provide adequate type anchors approved for specific application in compliance with manufacturer's allowable shear and tension values. Post-installed concrete anchors shall be ICC-ES #AC193 certified for cracked concrete installations.
 5. All pipe and equipment must be supported from the building structure and in no case may anything be supported from the ceiling grid system.
 6. Friction type clips of any type are prohibited.
 7. The use of perforated steel strap supports is prohibited.
 8. The use of plastic or power-driven anchors (driven into place by use of a powder charge, compressed air, gas, or any other propellant) is prohibited.

2.06 PIPE ANCHORS AND GUIDES

- A. Steel Pipe:
 1. Provide pipe anchors and guides where shown and elsewhere as required to control movement of piping.
 2. Anchors to be PHD Fig. 580 double bolt type, unless otherwise shown on the Drawings, securely welded to the pipe on both sides around the entire circumference of the pipe.
 3. Guides to be PHD Fig. 670 spider guide, size as required for insulation protection shield.
- B. Copper Pipe:
 1. Provide pipe anchors and guides where shown and elsewhere as required to control movement of piping.
 2. Anchors to be PHD Fig. 535 anchor chair with plastic-coated clamp.
 3. Guides to be PHD Fig. 470 pipe roller hanger or adjustable pipe roll stand bolted to Unistrut channel, size as required for insulation protection shield.

2.07 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

- A. Unions for Pipe of 2 Inches and Less:
 1. Ferrous Piping: 150 psi brass or malleable iron, threaded.
 2. Copper Pipe: Bronze, soldered joints.

- B. Flanges for Pipe 2 Inches and Greater:
 - 1. Ferrous Piping: 150 psig forged steel, slip-on.
 - 2. Copper Piping: Bronze.
 - 3. Gaskets: 1/16 inch thick, preformed neoprene.
- C. Mechanical couplings are not permitted.
- D. Dielectric Connections: Union or waterway fitting with water impervious isolation barrier and one galvanized or plated steel end and one copper tube end, end types to match pipe joint types used.

2.08 BALL VALVES

- A. Manufacturers:
 - 1. Milwaukee Valve Company: www.milwaukeevalve.com.
 - 2. Nibo Valve, Inc.: www.nibco.com
 - 3. Apollo/Conbraco: www.apollovalves.com
- B. Up To and Including 3 inches:
 - 1. Bronze two or three piece body, stainless steel ball, blowout-proof steel stem, PTFE seats and stuffing box ring, vinyl clad lever handle, threaded ends, 600 psi CWP, 150 psi SWP, MSS SP-110, maximum temperature - 300 degrees F.
 - 2. Furnish with stem extension for insulation thickness specified in Section 23 07 19.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment using jointing system specified.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- E. After completion, fill, clean, and treat systems. See Section 23 25 00 for additional requirements.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install heating water to ASME B31.9 requirements.
- C. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- D. Shutoff valves in water systems shall be ball valves in sizes 3" and smaller, butterfly valves in sizes 4" and larger.
- E. Route piping in an orderly manner, parallel to building structure, and maintain gradient.
- F. Install piping to conserve building space and to avoid interference with use of space.
- G. Group piping whenever practical at common elevations.
- H. Sleeve pipe passing through partitions, walls, and floors.
- I. Slope piping and arrange to drain at low points.
- J. Weld all steel piping in inaccessible chases and above inaccessible ceilings, regardless of pipe size.
- K. Ream all cut pipe to remove burrs. Apply pipe dope to male threads only. Threaded pipe to have plastic thread protectors until incorporated into the systems. Clean piping of all welding slag prior to closing systems.
- L. Water piping systems shall run level where practical. All piping shall be installed to permit draining and to permit air to travel to air vents. Install air vents as shown and at all high points

of the system. Install drain valves as shown and at all low points of the system. Install drain valves in all riser and piping sections as required to drain any section between isolation valves.

- M. Condensate drain lines from cooling coils shall be equipped with water seal trap and shall pitch down to outlet not less than 1/8" per foot.
- N. Welders on pressure piping shall be certified and shall carry their certification and stamp with them. Welds shall be stamped.
- O. Eccentric reducers shall be used for all pipe size changes with top of all water lines level.
- P. Pro-Press Connections: Copper press fittings shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
- Q. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
 - 2. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
 - 3. Place hangers within 12 inches of each horizontal elbow.
 - 4. Use hangers with 1-1/2 inches minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 7. Prime coat exposed steel hangers and supports. See Section 09 91 23. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 - 8. Where required to provide proper anchor point for pipe hangers, Contractor shall furnish and install angles or channels bridging joists. Secure members to joists with bolts or clamps; welding to be done only by specific approval of the Architect.
- R. Pipe Anchors and Guides:
 - 1. Anchor points as shown on Drawings or as required shall be located and constructed to permit the piping system to take up its expansion and contraction freely in opposite directions away from anchor points.
 - 2. Guide points shall be located and constructed wherever required or shown on Drawings to permit only free axial movement in piping systems.
 - 3. The Contractor shall bear all responsibility for materials and workmanship as described in this Section, and shall make sure that all hangers and supports are properly and permanently connected to building structure. Anchors shall be attached to a rigid structural element with additional support as necessary to prevent movement in any direction (including rotational movement). The Contractor shall design and install anchors to suit job conditions.
- S. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 23 07 19.
- T. Provide access where valves and fittings are not exposed.
- U. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.
- V. Install valves with stems upright or horizontal, not inverted.

3.03 UNIONS AND FLANGES

- A. Install unions adjacent to threaded shutoff valves. Union shall be located on the leaving side of supply valves and on the entering side of return valves.
- B. Install unions or flanges at the final connections to equipment.

- C. Install unions where required for construction and assembling purposes.
- D. Install unions on each side of traps.

3.04 SCHEDULES

- A. Hanger Spacing for Copper Tubing.
 - 1. 1/2 Inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 - 2. 1 Inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 - 3. 1-1/2 Inches and 2 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - 4. 2-1/2 Inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 - 5. 3 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- B. Hanger Spacing for Steel Piping.
 - 1. 1/2 Inch, 3/4 Inch, and 1 Inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
 - 2. 1-1/4 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - 3. 1-1/2 Inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 - 4. 2 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - 5. 2-1/2 Inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
 - 6. 3 Inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.

END OF SECTION

SECTION 23 21 14 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air vents.
- B. Strainers.
- C. Flexible connectors.
- D. Pressure-temperature test plugs.
- E. Balancing valves.

1.02 RELATED REQUIREMENTS

- A. Section 23 21 13 - Hydronic Piping.
- B. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

- A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.

1.04 SUBMITTALS

- A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.
- B. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- C. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 AIR VENTS

- A. Manufacturers:
 - 1. ITT Bell & Gossett: www.bellgossett.com (Basis of Design).
 - 2. Armstrong International, Inc: www.armstronginternational.com/#sle.
 - 3. Amtrol: www.amtrol.com.
 - 4. Taco, Inc: www.taco-hvac.com/#sle.
 - 5. Thrush: www.thrushco.com.
- B. Manual Air Vent: Short vertical sections of 2-inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
- C. Float Air Vent:
 - 1. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.
- D. Maximum Fluid Pressure: 150 psi.

- E. Maximum Fluid Temperature: 250 degrees F.

2.02 STRAINERS

- A. Manufacturers:
1. Keckley: www.keckley.com.
 2. Armstrong International, Inc: www.armstronginternational.com/#sle.
 3. Hoffman: www.hoffmanspecialty.com.
 4. ITT Bell & Gossett: www.bellgossett.com.
 5. Mueller: muellersteam.com.
 6. Spirax-Sarco: www.spiraxsarco.com.
- B. Size 2 inch and Under:
1. Provide threaded or sweat brass or iron body for up to 175 psi working pressure, Y-pattern strainer with 1/32 inch stainless steel perforated screen.
- C. Size 2-1/2 inch to 4 inch:
1. Provide flanged iron body for up to 175 psi working pressure, up to 250 degrees F working temperature, Y-pattern strainer with 3/64 inch stainless steel perforated screen.

2.03 FLEXIBLE CONNECTORS

- A. Manufacturers:
1. The Metraflex Company: www.metraflex.com/#sle.
 2. Senior Flexonics: www.flexonics.com.
 3. Flexicraft: www.flexicraft.com.
 4. The VMC Group: www.thevmcgroup.com.
 5. Flex-Weld: www.flex-weld.com.
- B. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
1. Maximum Allowable Working Pressure: 150 psig at 200 degrees F.
 2. Accommodate the Following:
 - a. Lateral Movement: 1/8 inch.
 - b. Force developed by 1.5 times specified maximum allowable operating pressure.
 3. End Connections: Flanged ductile iron; complying with ASME B16.1 Class 125.

2.04 PRESSURE-TEMPERATURE TEST PLUGS

- A. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.
- B. Application: Use extended length plugs to clear insulated piping.

2.05 COMBINATION BALANCE AND SHUTOFF VALVES

- A. Manufacturers:
1. ITT Bell & Gossett: www.bellgossett.com
 2. Armstrong International, Inc: www.armstronginternational.com.
 3. Griswold Controls: www.griswoldcontrols.com.
 4. Flow Design, Inc: www.flowdesign.com
- B. Calibrated ball-type balance valve with bronze body, brass ball, and TFE seat rings.
- C. Valves shall have differential pressure readout ports across valve seat area, with EPT check valves.
- D. Valve body shall have 1/4" NPT tapped drain/purge port.
- E. Valves shall have calibrated nameplates and adjustable memory stop.
- F. Valves shall be capable of 100% shutoff.
- G. Furnish with pre-formed insulation cover.

- H. Triple-duty valves are prohibited. Provide separate check valve and combination balance & shutoff valve.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Provide flexible connections on all pipes that connect to rotating machinery, such as pumps and chillers.
- C. Provide manual air vents at system high points and as indicated.
- D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
- E. Provide valved drain and hose connection on strainer blowdown connection. Furnish with cap and chain.
- F. Install all flexible connectors aligned with the mating pipes. Joints are not to be used to take up pipe misalignments.
- G. All flexible connectors to be sized to match I.D. of the connected pipe.

END OF SECTION

SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ducts.
- B. Nonmetal ducts.
- C. Ducts for laboratory and industrial-grade applications.
- D. Duct cleaning.

1.02 RELATED REQUIREMENTS

- A. Section 23 07 13 - Duct Insulation: External insulation and duct liner.
- B. Section 23 33 00 - Air Duct Accessories.
- C. Section 23 36 00 - Air Terminal Units.
- D. Section 23 37 00 - Air Outlets and Inlets: Fabric air distribution devices.

1.03 REFERENCE STANDARDS

- A. ANSI Z9.5 - Laboratory Ventilation; 2012.
- B. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- F. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2012.
- G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2013.
- H. NFPA 45 - Standard on Fire Protection for Laboratories Using Chemicals; 2015.
- I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- J. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.
- K. NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids; 2010.
- L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- M. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.04 SUBMITTALS

- A. Product Data: Provide data for duct materials and duct connections.
- B. Shop Drawings: Indicate duct fitting types, gauges, sizes, welds, and configuration.
 - 1. Provide detailed dimensional shop drawings of the sheetmetal ductwork systems for fabrication, installation, and coordination purposes. These drawings shall be a minimum of 1/8" scale for plan views and 1/4" scale for elevations, sections, and equipment room drawings.
 - 2. This Contractor shall be responsible for checking clearances with the Architectural, Structural, Fire Protection, Plumbing, and Electrical Contractors to ensure that the ductwork will fit properly as detailed.
- C. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.06 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A standards.

1.07 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.
- B. Ducts shall be constructed of galvanized steel, except fume hood exhaust ducts shall be CPVC.
- C. Duct Static Pressure Class:
 - 1. Supply ductwork from air handler to VAV box: 4 inch w.g. pressure class.
 - 2. Supply air ductwork after VAV box: 2 inch w.g. pressure class.
 - 3. Return, relief, locker exhaust, and outside air ductwork: 2 inch w.g. pressure class.
 - 4. Fume Hood and Laboratory General Exhaust: -4 inch w.g. pressure class.
- D. Duct Fabrication Requirements:
 - 1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
 - 2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
 - 3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
 - 4. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
 - 5. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.02 METAL DUCTS

- A. Material Requirements:
 - 1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Round Ducts: Machine made from round spiral lockseam duct.
 - 1. Manufacture in accordance with SMACNA (DCS).
 - 2. Fittings: Manufacture at least two gauges heavier metal than duct.
 - a. Elbows 8" diameter and smaller: Die-stamped, two piece, with continuous corrosion resistant welds.
 - b. Elbows over 8" diameter: Welded gore construction, not less than 5-gore for 90 degree elbows and 3-gore for 45 degree elbows, using corrosion resistant welds.

- c. Where noted on the Drawings, or where physical conditions prohibit the use of radius elbows, mitered 90 degree elbows may be installed. Mitered elbows shall have double wall turning vanes.
 - d. Tees, wyes, and other fittings shall be conical type where possible.
- 3. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
- 4. Manufacturers:
 - a. McGill Airflow: www.mcgillairflow.com.
 - b. SEMCO, Inc: www.semcoinc.com.
 - c. Tangent Air: www.tangentairinc.com.
 - d. Lindab: www.lindab.com.
- C. Flexible Ducts: UL 181, Class 0, interlocking spiral of aluminum foil.
 - 1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
 - 2. Pressure Rating: 8 inches wg positive or negative.
 - 3. Maximum Velocity: 5000 fpm.
 - 4. Temperature Range: Minus 20 degrees F to 250 degrees F.

2.03 DUCTS FOR LABORATORY AND INDUSTRIAL-GRADE APPLICATIONS

- A. Duct Class:
 - 1. Class 5: Corrosive fumes in light concentrations at a minimum conveying velocity of 1,000 to 2,000 fpm.
- B. Laboratory Exhaust Applications:
 - 1. Fume Hood Cabinet Exhaust:
 - a. Round, class 5, thermoplastic (CPVC) ductwork.
 - b. Provide ductwork and appurtenances in accordance with NFPA 91 requirements except where NFPA 45 applications take precedence.
 - c. Coordinate duct, fittings, hangers, and accessories to comply with ANSI Z9.5.
 - d. Design, fabricate, and install to be liquidtight preventing exhaust leakage into the building.
 - e. Operating Range: -4 in-wc in-wc.
 - f. Seal joints during installation with factory-supplied flanges and airtight gasketing.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install products following the manufacturer's instructions.
- C. Comply with safety standards NFPA 90A and NFPA 90B.
- D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.
- E. All ductwork to be installed true, plumb and parallel to the building lines. Joints to be suitable for the intended service and the ducts are to be securely fastened to the building structure.
- F. Due to limited ceiling space coordination between the trades is of the utmost importance. This Contractor will at all times, during layout and installation, provide the necessary coordination with all trades that will assure the installation of all work within the spaces provided.
- G. Locations of access doors in all ductwork to be indicated by stenciling minimum 1" high letters "AD" on the front of the access doors. Access doors for servicing of fire dampers shall be labeled "FIRE DAMPER" in ½" high letters. Stenciling of letters to be performed after the installation and painting of insulation.
- H. All excess duct sealant shall be wiped off ducts immediately to provide a smooth, finished appearance to all ducts. The use of duct tape is prohibited.
- I. Flexible Ducts: Connect to metal ducts with adhesive and draw bands.

1. Flexible duct is prohibited in return air, relief air and outside air ductwork except where specifically noted otherwise.
 2. Flexible duct may be used at inlets to supply diffusers and registers installed in lay-in ceilings.
 3. Flexible duct runs shall not exceed five feet in length.
 4. Each run of flexible duct shall include no more than one 90 degree bend, with a minimum bending radius of two times duct diameter.
- J. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.
- K. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- L. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with a crimp in the direction of airflow.
- M. Use double nuts and lock washers on threaded rod supports.
- N. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.
- O. Connect diffusers or light troffer boots to low-pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.
- P. Louver Fit-out:
1. Provide blank-out panels sealing available area of wall-mounted exterior-faced louver when connected ductwork is smaller than actual louver free area, and duct outlet is smaller than the louver frame.
 2. Use the same duct material painted black on the exterior side, then seal louver frame and duct.
- Q. Duct Insulation: Provide duct insulation in compliance with Section 23 07 13.
- R. Fittings and Accessories:
1. Avoid the use of square (mitered) elbows except where space constraints prohibit radiused elbows. Install turning vanes in all square elbows.
 2. Square elbows are prohibited in kitchen exhaust ducts.
 3. Install manual balancing dampers in all branch runouts to diffusers, registers, and grilles.
 4. All diverging tees in rectangular ductwork shall have a 45 deg. entry.
 5. Changes in size or shape of ducts to be made with a smooth transition with the included angle between the sides of the transition to be approximately 10 degrees, whenever possible.
 6. Unless shown otherwise, ducts which terminate at another duct, a plenum or a wall shall be constructed in such a manner that termination is made with a flared or bellmouthed fitting, so that inside surface of the duct, plenum or wall will remain smooth and devoid of protrusions.
- S. The sheet metal installer shall leave all balancing dampers, fire dampers and dampers on air devices in the open position as each item is installed. Splitter dampers, extractors and similar air diverting devices shall be left in a "neutral" position to divert a portion of the total air flow. All of the above devices will be adjusted later when the air balance is performed.
- T. The sheet metal installer shall position the air directional components on diffusers and registers in accordance with any arrows or notes on the drawings. This includes adjustable cones on diffusers, directional devices on linear diffusers, directional blades on supply registers and grilles, etc.

3.02 CLEANING

- A. Clean duct systems with high-power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters or bypass during cleaning. Provide adequate access to the ductwork for cleaning purposes.

END OF SECTION

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Duct access doors.
- D. Fire dampers.
- E. Flexible duct connectors.
- F. Volume control dampers.

1.02 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- C. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.
- D. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Product Data: Provide for shop-fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.
- B. Manufacturer's Installation Instructions: Provide instructions for fire dampers.
- C. Project Record Drawings: Record actual locations of access doors.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

- A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS - METAL

- A. Manufacturers:
 - 1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
 - 2. Nailor Industries, Inc: www.nailor.com/#sle.
 - 3. Ruskin Company: www.ruskin.com/#sle.
- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 DUCT ACCESS DOORS

- A. Manufacturers:
 - 1. Acudor Products Inc, a Division of Nelson Industrial Inc: www.acudor.com/#sle.
 - 2. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
 - 3. Nailor Industries, Inc: www.nailor.com/#sle.
 - 4. Ruskin Company: www.ruskin.com/#sle.
 - 5. SEMCO LLC: www.semcohvac.com/#sle.

- B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick-fastening locking devices. For insulated ducts, install minimum 1-inch thick insulation with sheet metal cover.
 - 1. Less Than 12 inches Square: Secure with sash locks.
 - 2. Up to 18 inches Square: Provide two hinges and two sash locks.
 - 3. Up to 24 by 48 inches: Three hinges and two compression latches with outside and inside handles.

2.04 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.05 FIRE DAMPERS

- A. Manufacturers:
 - 1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
 - 2. Nailor Industries, Inc: www.nailor.com/#sle.
 - 3. PCI Industries, Inc; Pottorff Brand: www.portorff.com.
 - 4. Ruskin Company: www.ruskin.com/#sle.
 - 5. Air Balance, Inc.: www.airbalance.com.
 - 6. Greenheck: www.greenheck.com.
 - 7. Safe-Air Dowco: www.safeair-dowco.com.
- B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- C. Horizontal Dampers: Galvanized steel, 22-gauge, 0.0299-inch frame, stainless steel closure spring, and lightweight, heat-retardant, non-asbestos fabric blanket.
- D. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1-inch pressure-class ducts up to 12 inches in height.
- E. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.06 FLEXIBLE DUCT CONNECTORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.
 - a. Net Fabric Width: Approximately 2 inches wide.
 - 2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.
- C. Maximum Installed Length: 14 inch.

2.07 VOLUME CONTROL DAMPERS

- A. Manufacturers:
 - 1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
 - 2. Nailor Industries, Inc: www.nailor.com/#sle.
 - 3. PCI Industries, Inc; Pottorff Brand: www.portorff.com.
 - 4. Ruskin Company: www.ruskin.com/#sle.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Splitter Dampers:
 - 1. Material: Same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.

2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
 3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.
- D. Single Blade Dampers:
1. Blade: 24 gauge, 0.0239 inch, minimum.
- E. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches. Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.
1. Blade: 18 gauge, 0.0478 inch, minimum.
- F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- G. Quadrants:
1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 31 00 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 8 by 8 inch size access door for hand and shoulder access, or as indicated on drawings. Provide minimum 4 by 4 inch size access door for balancing dampers only. Review locations prior to fabrication.
- D. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire-rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- E. Demonstrate re-setting of fire dampers to Owner's representative.
- F. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- G. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
- H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.
- I. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 34 23 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Utility vent blowers.
- B. Utility vent blower sets.

1.02 RELATED REQUIREMENTS

- A. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.
- B. Section 26 27 17 - Equipment Wiring: Electrical Characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; <http://www.amca.org/certified/search/company.aspx>.
- B. AMCA 99 - Standards Handbook; 2010.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.
- G. NEMA MG 1 - Motors and Generators; 2014.
- H. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- I. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.
- J. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- B. Manufacturer's Instructions: Indicate installation instructions.
- C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors, shafts, and bearings from weather and construction dust.

1.07 FIELD CONDITIONS

- A. Request Owner permission to use permanent ventilator(s) for ventilation during construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Greenheck: www.greenheck.com (Basis of Design).
- B. ACME Engineering and Manufacturing Corporation: www.acmefan.com.
- C. Loren Cook Company: www.lorencook.com.
- D. PennBarry: www.pennbarry.com.

- E. Carnes: www.carnes.com.

2.02 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: Comply with AMCA 204.
- B. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.
- C. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.
- D. Fabrication: Comply with AMCA 99.
- E. UL Compliance: UL 705, listed, labeled, designed, manufactured, and tested.
- F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- G. Enclosed Safety Switches: Comply with NEMA 250.

2.03 UTILITY VENT BLOWERS

- A. Manufacturers:
 - 1. Greenheck Fan Corporation: www.greenheck.com/#sle.
 - 2. Loren Cook Company: www.lorencook.com/#sle.
 - 3. PennBarry, Division of Air System Components: www.pennbarry.com/#sle.
 - 4. Twin City Fan & Blower; BCV: www.tcf.com/#sle.
 - 5. ACME Engineering and Manufacturing Corp: www.acmefan.com.
- B. Direct Drive Fan:
 - 1. Fan Wheel:
 - a. Type: Non-overloading, backward inclined centrifugal.
 - b. Material: Coated steel.
 - c. AMCA Class II construction.
 - 2. Statically and dynamically balanced.
 - 3. Motors:
 - a. Open drip-proof (ODP).
 - b. Heavy duty ball bearing type.
 - c. Mount on vibration isolators or resilient cradle mounts, out of air stream.
 - d. Fully accessible for maintenance.
 - e. Furnish with VFD and constant pressure duct static controller. Set to maintain -1.0".
 - 4. Housing:
 - a. Construct of heavy gage galvanized steel; mechanically fastened housing.
 - b. AMCA Class II construction.
 - c. Rigid internal support structure.
 - d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
 - e. Provide fan scroll with bolted, gasketed, hinged access door.
 - f. Drain connection: 1" pipe thread with plug.
 - g. Inlet: Flanged.
 - h. Outlet: Flanged.
- C. Shafts and Bearings:
 - 1. Fan Shaft:
 - a. Ground and polished steel with anti-corrosive coating.
 - b. First critical speed at least 25 percent over maximum cataloged operating speed.
 - c. Shaft seal.
 - 2. Bearings:
 - a. Permanently sealed or pillow block type.
 - b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
 - c. 100 percent factory tested.

- D. Provide weather cover on motor and drive assembly.
- E. Options/Accessories:
 - 1. Dampers: Provide gravity type.
 - 2. Finishes: Standard factory finish.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide backdraft dampers on outlet from utility set fans and as indicated.

END OF SECTION

SECTION 23 36 00 - AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single-duct terminal units.
 - 1. Constant-volume units.
 - 2. Variable-volume units.
- B. Fan-powered units.
- C. Integral heating coils.
- D. Integral damper motor operators.
- E. Integral controls.

1.02 RELATED REQUIREMENTS

- A. Section 23 21 13 - Hydronic Piping: Connections to heating coils.
- B. Section 23 21 14 - Hydronic Specialties: Connections to heating coils.
- C. Section 23 31 00 - HVAC Ducts and Casings.
- D. Section 23 33 00 - Air Duct Accessories.
- E. Section 23 37 00 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

- A. AHRI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils; 2001 (R2011).
- B. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2011 with Addendum 1.
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- D. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; Sheet Metal and Air Conditioning Contractors' National Association; 2008.
- E. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
 - 1. Include schedules listing discharge and radiated sound power level for each of the second through sixth-octave bands at inlet static pressures of 1 to 4 in-wc.
- B. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.
- C. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Price Industries: www.price-hvac.com (Basis of Design).

- B. Titus: www.titus-hvac.com
- C. Krueger: www.krueger-hvac.com.

2.02 MANUFACTURED UNITS

- A. Identify each terminal unit with clearly marked identification label and air flow indicator. Include unit nominal air flow, maximum factory set airflow, minimum factory set air flow, and coil type.

2.03 SINGLE-DUCT, VARIABLE-VOLUME AND CONSTANT-VOLUME UNITS

- A. General:
 - 1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
 - 2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.
- B. Unit Casing:
 - 1. Minimum 22 gauge, 0.0299 inch galvanized steel.
 - 2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
 - 3. Unit Discharge: Rectangular, with slip-and-drive connections.
 - 4. Acceptable Liners:
 - a. 1" thick 1-1/2# density closed cell polymer foam insulation which complies with UL-181 and NFPA-90A. Insulation shall be mechanically fastened to the unit casing. Fiberglass insulation is not acceptable.
 - b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.
 - 5. Provide hinged access door in bottom of unit casing for access to coil face and damper.
- C. Damper Assembly:
 - 1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
 - 2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
 - 3. Incorporate low leak damper blades for tight airflow shutoff.
- D. Hot Water Heating Coil:
 - 1. Coil Casing: Minimum 22 gauge, 0.0299 inch galvanized steel, factory-installed on terminal discharge with rectangular outlet, duct connection type.
 - a. Access Door: Gasketed and insulated located on bottom and upstream of coil.
 - 2. Coil Fins: Aluminum or aluminum plated fins, mechanically-bonded to seamless copper tubes.
 - 3. Coil leak tested to minimum 300 psig.
 - 4. Base performance data on tests run in accordance with AHRI 410 and units to bear AHRI 410 label.
- E. Control Transformers: Factory supplied and mounted for electric and electronic control applications.
- F. Controls:
 - 1. DDC (Direct-Digital Controls):
 - a. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
 - b. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFMs.
 - 1) Controller will be furnished and field-installed by the Building Automation System (BAS) contractor.
 - 2) Manufacturer shall provide static pressure sensor and tubing for field connection to controller.
 - 3) Occupied and unoccupied operating mode.

- 4) Remote reset of temperature or CFM set points.
- 5) Proportional, plus integral control of room temperature.
- 6) Monitoring and adjusting with portable terminal.
- c. Room Sensor:
 - 1) Compatible with temperature controls specified.
 - 2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.
- d. Wiring:
 - 1) Provide terminals in control box for field connection of box controller. Mount electrical components in control box with removable cover. Incorporate single point electrical connection to power source.
 - 2) Factory mount transformer for control voltage. Provide terminal strip in control box for field wiring of power source.

2.04 MANUFACTURED UNITS

- A. Ceiling mounted variable air volume supply air control terminals for connection to single duct, central air systems, with electronic variable volume controls,, hot water heating coils.
- B. Identify each terminal unit with clearly marked identification label and air flow indicator. Include unit nominal air flow, maximum factory set airflow, minimum factory set air flow, and coil type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are suitable for installation.
- B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.
- C. Provide ceiling access doors or locate units above easily removable ceiling components.
- D. Support units individually from structure in accordance with SMACNA (SRM).
- E. Do not support from ductwork.
- F. Connect to ductwork in accordance with Section 23 31 00.
- G. Verify that electric power is available and of the correct characteristics.

3.03 ADJUSTING

- A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to scheduled minimum flow.

END OF SECTION

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers:
- B. Registers/grilles:

1.02 RELATED REQUIREMENTS

- A. Section 09 91 23 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

- A. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2006 (Reaffirmed 2021).
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- C. Project Record Documents: Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Krueger-HVAC: www.krueger-hvac.com/#sle.
- B. Price Industries: www.price-hvac.com/#sle.
- C. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- C. All devices shall be installed in ceilings and walls plumb and square with the building lines.
- D. Devices which have factory finish marred shall be touched up or refinished as directed by the Architect.
- E. Install diffusers to ductwork with air tight connection.
- F. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- G. Paint ductwork visible behind air outlets and inlets matte black, see Section 09 91 23.

END OF SECTION

SECTION 23 72 23 - PACKAGED AIR-TO-AIR ENERGY RECOVERY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Casing.
- B. Fans.
- C. Filters.
- D. Dampers.
- E. Power and controls.
- F. Accessories.

1.02 REFERENCE STANDARDS

- A. AHRI 1060 (I-P) - Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment; 2018.
- B. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012, with 2015 amendments.
- C. ASHRAE Std 84 - Method of Testing Air-to-Air Heat/Energy Exchangers; 2020, with Errata (2021).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- E. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2014.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

1.03 SUBMITTALS

- A. Product Data: Manufacturer's installation instruction, product data, and engineering calculations.
 - 1. General layout drawing with plan and elevation views including all relevant dimensions.
 - 2. Performance schedule including airflow, heating and cooling capacities, electrical data, unit weight.
 - 3. Full fan curve.
 - 4. Sound power data by octave band for all openings and radiated through the cabinet.
 - 5. Electrical schematics including field wiring connections.
 - 6. Component details including construction method and materials.
 - 7. Control point schematic and complete written sequence of operation.
- B. Shop Drawings: Show design and assembly of energy recovery unit and installation and connection details.
- C. Operation And Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- D. Closeout Submittals: Submit manufacturer's operation and maintenance instructions.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Spare Parts: One set of each type and size of filter.

1.04 QUALITY ASSURANCE

- A. Entire unit shall be UL 1812 or UL 1995 certified and bear certification label by ETL, UL or CSA.
- B. Unit shall meet ASHRAE Standard 90.1 performance requirements.

- C. Unit sound data will be tested in accordance to AHRI 260.
- D. Manufacturer Qualifications:
 - 1. Firm regularly engaged in manufacturing energy recovery units.
 - 2. Products in satisfactory use in similar service for not less than five years.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store in manufacturer's unopened packaging.
- B. Store products to be installed indoors in dry, heated area.
- C. Follow manufacturer's instructions for rigging and placement of equipment.

1.06 WARRANTY

- A. Warranty ventilator to be free from defects in material and workmanship and of all parts for period of 1-1/2 years from date of Substantial Completion.
- B. Warranty dessicant core to be free from defects in material and workmanship for 5 years under circumstances of normal use.
- C. Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Energy Recovery Ventilators:
 - 1. Oxygen8: www.oxygen8.ca.
 - 2. RenewAire: www.renewaire.com/#sle.
 - 3. Greenheck: www.greenheck.com.

2.02 ENERGY RECOVERY UNITS

- A. General:
 - 1. ERV units shall be factory assembled and tested. Units shall include insulated steel cabinet with steel base, total energy plate heat exchanger, chilled water cooling coil, hot water reheat coil, fan and motor assembly, filter rack, and integral controls. Unit shall have single point power connections.
- B. Cabinet:
 - 1. Cabinet shall be nominal 1 inch double wall panel with R6.5 thermal insulation. Cabinet exterior shall be 22 gauge pre-painted steel that meets or exceeds 650 hour salt spray test based on ASTM B117. Liners and other steel components shall be galvanized steel. All seams shall be sealed to provide air tight casing.
 - 2. Doors shall be nominal 1 inch double wall panel with the same construction as cabinet. Doors shall be fitted with hinges and door handles. The doors shall have one lockable handle as standard.
 - 3. The unit will be designed for service and maintenance on one side only to allow for a compact installation.
 - 4. All dampers shall have extruded heavy gauge 6063 aluminum frame that includes jamb seals. Blades shall be airfoil shaped extruded aluminum and include rubber blade seals. Linkage shall be installed in the frame outside of the airstream.
 - 5. All dampers shall include factory mounted, wired and tested actuators. Dampers shall be two-position. Provide spring return dampers for outdoor air and exhaust air connections (fail closed).
 - 6. Unit shall include outside air and exhaust air dampers to close when unit is off.
- C. Filters:
 - 1. Unit shall include 2" filter rack for the supply air and return air paths upstream of energy recovery exchanger. Filters shall be accessed through hinged filter access door. Supply two sets of MERV8 for the Return air stream. All filters must be UL approved.

2. Supply two sets of MERV 13 pleated filters for the Outdoor air stream to be installed in duct-mounted filter rack upstream of preheat coil.
 3. Provide pressure sensors to measure filter pressure drop across pre-filter and main filter. Pressure drop shall be digitally fed back to controller for utilization in control and alarm sequencing. Unit controller shall monitor filter pressure level and report when filter changes are required.
- D. Fans:
1. Fans shall be mixed flow plenum type with direct drive motor. Fan and motor assembly shall be factory mounted and balanced. The fans will be capable of operating in ambient temperatures of up to 104°F.
 2. The fans must be sized to have a specific fan power of <1 Watt/CFM.
 3. Fan motors shall be permanent magnet, synchronous motor type with integral digital motor controller. Fan bearings shall be serviceable type with an L-10 life of 40,000 hours. Fan motors will be UL approved.
 4. All fans shall be equipped with integral airflow monitoring system connected to the unit controller.
 5. Provide means to easily remove fan-motor assembly for service through standard doors.
 6. Fans should be designed such that all service can be performed in the field, including replacement of bearings.
 7. Fan motor drives shall be 208/60/3 and be UL approved. Fans will be protected by UL approved motor protection circuit breaker.
- E. Energy Recovery Device:
1. Units shall include plate type cross flow heat exchanger fabricated from aluminum. Maximum pressure differential shall be 7.2" w.c. Maximum leakage between airstreams shall be 0.5% of nominal airflow.
 2. The energy recover efficiency must be a minimum of 50% Total to meet ASHRAE 90.1.
 3. The energy recovery device must have an ISO Hygiene rating of 0.
- F. Controls:
1. Unit shall include an integrated microprocessor-based unit controller. The controls shall be located in the integral control cabinet. All unit controls shall operate off a transformer from the main power supply for single point power connection. All internal controls and sensors shall be factory prewired and tested. The microprocessor shall have dual Ethernet ports with an internal firewall to allow remote access via third party without compromising the Owner's internal Network.
 2. Include with each unit touch pad type human interface that allows monitoring and control of all unit functions. Human interface shall communicate with unit controller by hardwire connection. Human interface shall be unit mounted.
 3. The control system will regulate temperatures, airflows and other functions as required. Unit controller shall be pre-programmed with factory tested software for all possible functions.
 4. The controller shall provide the following, refer to sequence of operation for specific unit control sequences:
 - a. Control of fans correcting for both changes in total static pressure and air density in both VAV and constant airflow applications.
 - b. Fan performance monitoring.
 - c. Ventilation airflow monitoring and control.
 - d. Airflow density correction for winter and summer conditions.
 - e. Energy recovery optimization including operation of heat exchanger bypass damper.
 - f. Frost protection.
 - g. Monitoring alarms, faults and maintenance points including filter changeout.
 - h. Time and date schedules.
 - i. Humidity control.
 - j. Data logging and trending.

5. Controller shall be native BACnet certified and include Modbus communication. Communication shall include monitoring, control, alarms, faults and maintenance information.
 6. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
 7. Provide factory installed and tested contactors, overloads, fusing, starters, motor speed controllers for supply and exhaust. Include all necessary control transformers.
 8. Provide unit mounted non-fused disconnect switch with single point power connection.
 9. Supply all necessary temperature and pressure sensors complete with plug in wiring harnesses for proper operation of unit.
- G. Electric Preheat Coil:
1. Electric slip-in style heat section.
 2. Open coil heating elements shall be 80% nickel and 20% chromium; steps shall be arranged to prevent stratification when operating at less than full capacity. Elements for draw-through air handling units shall be derated to 35 watts per square inch.
 3. Element terminals shall be stainless steel; insulators and bracket bushings shall be nonporous ceramic and securely positioned. Terminals shall be machined crimped to elements.
 4. Frame should be constructed of heavy gauge galvanized steel with galvanized steel brackets, stiffening ribs and gussets spot welded to the frame.
 5. Terminal box shall be spot welded construction with solid, hinged cover, totally enclosed, without louvers or grilles per the UL standard.
 6. Airflow direction shall be scheduled. Heater control panel shall be located on same side of unit as drive on fan.
 7. Safety devices: a disc-type automatic reset thermal cutout, pressure differential airflow switch, and door interlock switch shall be furnished for primary over temperature protection. All safety devices shall be serviceable through the terminal box without removing the heater from the unit.
 8. Wiring Diagrams: a unique wiring diagram shall be furnished for each heater. Diagram shall include recommended supply wire gauges per NEC and fuse sizes. Typical Wiring Diagrams are not acceptable.
 9. Built-in components shall include safety devices, disconnecting break magnetic contactors, transformer with primary fusing per UL, pressure type airflow switch set at .05" WC, supplementary circuit fuses per NEC (one set fuses per 48 amp circuit) , and separate load and terminal blocks to accept conductors as shown on the electrical plan.
 10. Furnish with SCR 0-10 VDC controller to receive a modulating signal from the BAS system to maintain preheat coil discharge air temperature setpoint.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Verify that required electrical services and control wiring have been installed and are in the proper locations prior to equipment startup. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).
- C. Verify that condensate piping has been installed and insulated and is in the proper location prior to equipment startup. See Section 23 21 13 Hydronic Piping.

3.02 SYSTEM STARTUP

- A. Engage factory authorized service technician to start up and commission units. Provide start up report to Owner.
- B. Start-up technician shall work with the Building Automation System installer to integrate all available software points into the Building Automation System graphics through the BACnet interface.

- C. Configure units to operate in accordance with Sequence of Control as stated in Section 23 09 93 Sequence of Operations for HVAC Controls.

3.03 CLOSEOUT ACTIVITIES

- A. Demonstrate operation to Owner's maintenance personnel.
 - 1. Use operation and maintenance data as reference during demonstration.
 - 2. Briefly describe function, operation, and maintenance of each component.
- B. Train Owner's personnel on operation and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of 16 hours of training.
 - 3. Instructor: Manufacturer's training personnel.
 - 4. Location: At project site.

3.04 CLEANING

- A. Clean air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.
- B. Install clean set of filters upon acceptance of system by the Owner.

END OF SECTION

SECTION 26 05 00 - ELECTRICAL GENERAL PROVISIONS

PART 1 GENERAL

1.01 EXTENT OF WORK

- A. Furnish all labor, material, tools, and equipment and install complete all work hereinafter specified and as shown on the Drawings, and any and all details essential to complete the installations, whether same are specifically mentioned or not. Any material or labor which is neither shown on the Drawings, nor called for in the Specifications, but which is obviously necessary to complete the work and which is usually included in work of a similar character, shall be furnished and installed without additional cost.
- B. Instructions to Bidders; General Conditions; Special Conditions; and Division 1 - are a part of this Division.

1.02 GENERAL REQUIREMENTS

- A. Read all Specifications and Drawings covering all branches of work so as to be fully informed regarding the work to be done as a part of this Contract.
- B. The Drawings are complementary to the Specifications. Whatever is called for by one shall apply to both unless specifically stated or shown otherwise. Any discrepancies to be clarified with the Architect during the Bidding Period.
- C. Material and equipment installed under this Contract shall be new, un-deteriorated and of quality not less than the minimum specified herein. Materials for which Underwriters' Examination Service is provided shall bear the U.L. or equivalent label.
- D. Workmanship and installation procedures to be in accordance with best practices of the trade. Electrical work to be installed by journeymen electricians under direct supervision of qualified and competent foremen. At no time is Electrical work to be installed by apprentice electricians or laborers without the immediate on-the-job supervision of a journeyman electrician. Work to meet or exceed standards of installation and good workmanship set forth in the "NECA Standard of Installation" except as modified in these Specifications or shown on the Drawings.
- E. Furnish and install all necessary hangers, supports, straps, pull boxes, junction boxes and fittings not indicated on the Drawings, but which are required for a complete and properly installed system, consistent with the architectural treatment of the Building.
- F. The Contractor and its employees involved in the installation, service or maintenance of the fire alarm system shall have a valid "Fire Protection Certification" as required by the State Department of Commerce.
- G. Consult all Contract Drawings which may affect the locations of equipment, conduit, or wiring and make minor adjustment in location to assure coordination. Other than minor adjustment to be submitted to the Architect for approval before proceeding with work.
- H. Before the Building is turned over to the Owner for beneficial occupancy, carefully make adjustments necessary for the proper functioning of all systems and equipment required under this Contract and instruct a representative of the Owner in the care and operation thereof.
- I. Architect reserves the right to direct the removal and replacement of any item of work which, in his opinion does not present an orderly, reasonably neat and workmanlike appearance, provided such items can be properly installed in such orderly way by methods usual in such work. Such removals or replacements to be done by this Contractor when so directed by the Architect and all cost in connection therewith to be paid by this Contractor.
- J. Work found unacceptable by testing procedures, inspection agencies or Architect will be immediately corrected at no additional cost to the Owner. Work will be considered unacceptable when it is contrary to the Specifications, governing codes or accepted standards of good workmanship.
- K. Insofar as this branch of work is concerned, keep premises in neat and orderly condition and promptly clean up and cart away debris and excess material.

- L. The design shown on the Drawings is based on particular types or makes of equipment (Basis of Design). If other listed types or makes of equipment (Acceptable Components) are furnished, which require modifications or changes in the Drawings or Specifications, this Contractor shall be responsible for such changes, the cost of which shall be included in the Bid. In such case, prior to starting work, submit to Architect for approval drawings and specifications showing such modifications and changes. Do not proceed with work until approval has been obtained. Submittal of such equipment will be considered as a statement by the Contractor and manufacturer that required clearances and compatibility with other systems have been checked and found adequate; See "Instructions to Bidders".
- M. Unless otherwise noted, the following definition shall apply: The term "furnish" shall mean to obtain and supply to the jobsite. The term "install" shall mean to fix in position and connect for use. The term "provide" shall mean to furnish and install.

1.03 SCHEDULING AND ORDER OF WORK

- A. Upon approval of Contract, prepare a schedule, prior to starting operations, of all stages of electrical work and sequence to be performed.
- B. Scheduling and associated approval procedures to be in accordance with General Conditions or as instructed by the Architect.
- C. Refer to Division 01 for areas of Building where special scheduling of work and restricted working hours will be in effect.
- D. Scheduling of work to be coordinated with delivery schedules and work schedules prepared by other trades directly involved.
- E. Electric outages to be scheduled and approved in advance with the Owner in coordination with the Architect.
- F. Materials and equipment required during a scheduled electrical outage to be on hand prior to starting of operations in order to ensure expeditious conclusion.

1.04 CODES

- A. Perform all work in accordance with the 2023 edition of the National Electrical Code as issued by the National Fire Protection Association, the current edition of the Ohio Building Code, and any prevailing codes of the county, political sub-division or local governmental agency having jurisdiction.
- B. The above codes are minimum requirements. Where the Drawings and Specifications call for higher requirements the Drawings and Specifications shall govern.

1.05 PERMITS, INSPECTIONS AND FEES

- A. Refer to General Conditions Article 5.2 for building and trade permits and licenses.
- B. Permits: Obtain all permits of state, county, city, political sub-division or local governmental agency having jurisdiction required by law or ordinance. File any Drawings necessary to obtain said permits.
- C. Inspections
 - 1. Electrical inspection to be performed by the inspection agency having jurisdiction for the area.
 - 2. Notify inspection agency for inspections of work before work is concealed.
 - 3. Work found unacceptable by the Architect or inspection agencies to be immediately corrected at no additional cost to the Owner. Work to be considered unacceptable when it is contrary to Drawings, Specifications, governing codes and accepted standards of good workmanship.
 - 4. Fees: Electrical Contractor to pay fees for the above required permits and inspections.

1.06 EMERGENCY SERVICE

- A. Emergency service shall be provided for installation or equipment failures in any part of the Electrical work, on verbal demand, prior to final acceptance and during the Guarantee period.

- B. The Owner will designate three (3) individuals who will initiate the call for emergency service. The Contractor shall, in turn, designate three (3) individuals, together with current telephone numbers, who will and can perform the emergency service.
- C. Emergency services performed which are not due to defects of work or materials supplied by this Contractor will be paid by the Owner.

1.07 SHOP DRAWINGS AND SUBMITTALS

- A. See Division 00 and Division 01 for submittal procedures and additional requirements.
- B. Shop drawings and submittals shall be provided for any and all items required by the contract documents, including but not limited to: all components of the distribution system, wiring system, wiring devices and coverplates, and all auxiliary systems being supplied.
 - 1. Shop drawings for distribution equipment to include front view, side view, plan view, dimensions, bussing diagram, bussing material and bracing, main and feeder devices, accessories, nameplate schedule, etc.
 - 2. Catalog cuts and specification sheets may be used as submittals for items such as wiring devices, coverplates, wire, fuses etc. This information shall be adequately described and all requirements and options of the exact items being furnished shall be clearly marked.
- C. Electrical contractor shall review, approve and stamp shop drawings and submittals to ensure contract requirements are met before forwarding. By reviewing and stamping shop drawings and submittals, the Contractor indicates that he has determined and verified materials, field measurements and related field construction criteria, or will do so, and has coordinated all information with the requirements of the work, contract documents, and other trades.
- D. The Architect's review of shop drawings and submittals shall not relieve the Contractor from responsibility of errors or omissions in manufacturer's drawings and deviations from the Architect's drawings or specifications.
- E. The above required shop drawing and review submittals are for review for installation in accordance with the contract drawings and specifications and in no way void the requirements of the "general conditions" for material and equipment list submittals subsequent to the signing of the contract.
- F. Submittals to be itemized on a transmittal sheet. Each set to be complete with a title sheet, stating the project name and location, Engineer, Contractor and a table of contents. Allow sufficient space for review stamps.
- G. Shop drawings and review submittals not received as described above shall be returned without consideration of reviewing.

1.08 JOB CLOSING SUBMITTALS

- A. Refer to Division 00 and Division 01- General Requirements for closeout submittals.
- B. Operation and Maintenance Manuals
 - 1. See Division 01 for requirements.
- C. Record Set of Contract Drawings
 - 1. Provide a clean set of Contract Drawing prints marked in red pencil, showing all deviations from the Contract Drawings. Deviations to include the location of junction box or pullboxes installed, conduit routing or rerouting, adjustment in locations, mounting heights, circuiting, etc.
 - 2. Prints to be maintained at Project and kept current every day with job progress throughout Contract period.
 - 3. Upon completion of the project and before final approval, make any final corrections to the Drawings and certify to the accuracy of each print by signature and a date thereon and deliver same to the Architect.
- D. Personnel Instruction: Provide a minimum of one (1) hour total instruction to Owner personnel. Instructions shall include the following:
 - 1. Location of items of equipment and explanation of what they do.

2. Reference to Operation & Maintenance Manual for record and clarity.
3. Coordination of written and verbal instruction so that each is understood by personnel. Advise on maintenance and repairs.
4. Prepare a certificate to be signed by the person or persons being instructed. Certificate shall indicate date and time instructions were given, by whom given, and that the persons receiving the instructions fully understood the system operation. Submit signed certificate to Architect.

1.09 INSPECTION OF SITE

- A. The Bidder's failure to become acquainted with the extent and nature of work required to complete any portion of the Work in conformity with the requirements of the Contract Documents shall not be a basis for additional compensation. Bidders are encouraged to visit the site during bidding period to examine and evaluate the Site and related Project Conditions where the work will be performed.

1.10 ELECTRIC, TELEPHONE AND AUXILIARY SYSTEMS SERVICE INTERRUPTIONS

- A. Electric, telephone and auxiliary systems services to existing Facilities, Buildings or parts of Buildings to be maintained at all times except during times of authorized interruptions.
- B. The adjacent buildings will be occupied during construction. Electric, telephone and auxiliary systems service to occupied areas are to be maintained at all times unless specifically requested not to by Architect.
- C. By nature of the occupancy of the adjacent buildings, in certain spaces in which work is to be performed, outages cannot be available to the Contractor at his convenience.
- D. INTERRUPTION OF TELEPHONE SERVICE
 1. The scheduling of telephone service interruptions to be in advance with the Architect by written request stating work to be performed, amount of time requested to perform work and the total duration of interruption. This is to be done at least fourteen (14) days before anticipated outage and be approved by the Owner before any work is done.
- E. INTERRUPTION OF ELECTRIC SERVICE
 1. The scheduling of electric service interruption to be in advance with the Architect by written request stating work to be performed, time requested to perform work and duration of interruption. This is to be done at least fourteen (14) days before anticipated outage and be approved by the Owner before any work is done.
- F. INTERRUPTION OF AUXILIARY SYSTEMS
 1. The scheduling of auxiliary systems service interruptions to be in advance with the Owner by written request stating work to be performed, amount of time requested to perform the work and the total duration of the interruption. This is to be done at least fourteen (14) days before anticipated outage and be approved by the Owner before any work is done.
- G. OVERTIME
 1. Interruption times as approved or specified by Architect to be binding, final and no extra compensation will be made for overtime work in connection therewith.
- H. ON SITE MATERIALS
 1. Materials and equipment required during outage periods to be on hand at start to assure expeditious conclusion.

1.11 LOAD BALANCE TEST AND REPORT

- A. Conduct such tests and adjustments of equipment as requested by the Architect or which are necessary to verify performance requirements and compliance of the installation with these Specifications, Drawings, governing codes or accepted standards of good workmanship.
- B. Tests to include operation of lighting and mechanical equipment. Tests associated with the continuity of the conduit system, ground resistances or insulation resistances to be performed on any circuit for which a justifiable reason exists.

- C. All labor and testing equipment required for the performance of tests to be furnished by this Contractor.
- D. Building lighting, motor and appliance loads to be connected and wired to circuit numbers as shown on the Drawings and balanced between phases of the service entrance and distribution feeders as closely as possible.
- E. Upon completion of the electrical work, test the connected full load lighting, motor and appliance phase balance of the service and distribution feeders. Test results to be recorded and reported to the Architect in writing.
- F. Test equipment to be tong type "clip-on" recordable ammeter furnished by this Contractor. All tests to be witnessed by the Architect representative and all labor for testing and adjustment will be furnished by this Contractor.
- G. Perform an additional load balance test after full occupancy between 8:00 A.M. and 6:00 P.M. of a weekday. Record results and submit to Architect.
- H. Refer to other specific sections of these Specifications for additional test requirements.

1.12 EXCAVATION, BACKFILLING AND PROTECTION OF UTILITIES

- A. Perform all excavation, backfilling and protect utilities necessary for and incidental to the installation of this work. Bidders shall study the site and the Drawings to acquaint themselves of all existing and new conditions affecting the work of this Contract.
- B. Refer to Division 01 for protection and safety requirements.
- C. EXCAVATION
 - 1. Perform all excavation for electrical work to required depths hereinafter specified, required for other utility crossings or shown on the Drawings as determined from final grade contours. Excavation to be open cut method through any material encountered.
 - 2. Trenches to be of necessary width for the proper laying of cable or conduits and the banks to be a nearly vertical as practicable. Bottom of trenches to be accurately graded to provide proper slope and be at least four (4) inches below cable or conduits.
 - 3. Install sheeting and shoring necessary for protection of work and safety of personnel.
 - 4. Remove all stumps, rock, abandoned structure foundations, etc., in the line of excavation. Where excavation is required near trees, use extreme care and protect tree and root system. Shrubs in the line of excavation shall be balled and replanted. Obtain approval of Architect before removing any trees.
 - 5. Grading to be done as necessary to prevent surface water from flowing into trenches or other excavations and any water accumulating therein to be removed by pumping or other approved method.
 - 6. Where existing pavements must be cut, cut in straight lines and present a neat appearance when re-laid and shall match existing work.
 - 7. Conserve sod where excavating through lawn areas; stockpile and replace with stockpiled or new sod, as required, to ensure regrowth. Lawn areas to be left raked clean.
- D. BACKFILLING
 - 1. Backfilling not to be performed until the cable or conduit systems are inspected and approved by the inspection agency.
 - 2. Backfill material shall not contain broken rock, stones, debris, frozen or soft material. Wet backfill materials, if too dry or blend dry materials if too wet, to obtain within 2% of optimum moisture content. Backfill to be deposited in 6" loose layers, each layer compacted with mechanical tampers to the above specification density before the next layer is placed. Grits are prohibited as backfill material.
 - 3. Overdepth excavations to be backfilled to bedding grade with loose granular moist earth, thoroughly compacted by mechanical tampers. Wherever wet or unstable soil is encountered in a trench, which in the opinion of the Architect is not suitable for bedding, such material to be removed and be backfilled to bedding grade with bank run gravel compacted in place.

4. Material suitable for backfilling to be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or suitable for backfill to be removed from the premises and disposed of.
5. Backfill of trenches in lawn areas to be performed with excavated materials, in suitable.
6. Backfill under Building construction to be 46D - gravel and dust, tamped and watered to 6" layers.
7. Backfill under Building walls and footers to be concrete, of the same strength as walls or footers.
8. Backfill under road and drive construction to be 46D - gravel and dust, tamped and watered to 6" layers after minimum time of concrete encasement to set.
9. Excavation and backfill to be completed before final grading.
10. Top of trenches to be neatly mounded.
11. It shall be an obligation of this Contractor to furnish required suitable backfill materials and remove all surplus excavated material from the premises. It shall also be an obligation of the contractor to repair all damages to pavements and lawns and restore in kind to the same condition as before the work is begun.

E. COMPACTION

1. Soil compaction control shall be furnished by this Contractor for all fill and backfill associated with the installation of underground conduit in this contract.
2. Soils shall be compacted to the following densities as determined by standard proctor tests:
 - a. Inside structure, under non-structural slabs on grade, 95%.
 - b. Inside structure, under special foundations, isolation pads, and footings, 100%.
 - c. Outside structure, trench compaction under paved surfaces:
 - 1) Shallow trenches less than 18" deep above pipe shall be filled with K-Krete.
 - 2) Trenches deeper than 18" shall be compacted as described below and the top 18" of trench shall be filled with K-Krete:

Maximum Lab Dry Weight	Minimum Compaction Percent Of Lab Maximum
90.0 - 104.9	100
105.0 - 119.9	98
120.0 and more	96

- d. Foundation Backfill Under Planting Beds and Lawn: The upper 2 feet of soil below finish grade - 90% maximum. Remainder of backfill - 95% if depth is less than 10 feet; - 100% if depth exceeds 10 feet.
- e. Foundation Backfill Under Pavements: 100%
- f. Under Paved Pedestrian Walks and Courts: 95%
- g. Backfill Around Manholes and Other Underground Structures: 95% if depth is less than 10 feet; 100% if depth is more than 10 feet. Under lawn And Planting Areas Which Are Not Adjacent To Structures: The upper 1 foot of soil below finish grade - 90% maximum. Remainder - 95%.

1.13 PROTECTION OF UTILITIES

- A. This Contractor to acquaint himself with the location of all existing and new underground utilities before excavation work is begun
- B. Excavation damage to any underground utility to be a liability of the Contractor whether or not plotted on the Drawings and all damages to any existing utility to be promptly repaired or replaced to the full satisfaction and release of liability of the Owners of such utilities.
- C. Locations of existing underground utilities shown on the Drawings were obtained from the existing utility Drawings. Utility locations are shown for reference only and locations and depths

shown may not be accurate. Extreme care to be taken during excavation for utilities. Relocations in new construction may be necessary in order to coordinate installation of new work with existing conditions.

1.14 LAYOUTS, BUILT-IN WORK AND COORDINATION

A. LAYOUTS

1. The layout shown on the Drawings is schematic, exact locations are to be determined at the project site by coordination with Architect and structural and other conditions. This does not mean that the design of the system may be changed; it refers only to the exact locations of conduits and equipment to fit into the Building as constructed and the coordination of conduit and other equipment with the other trades piping, ductwork and equipment.
2. Where the locations of any items are indicated by dimension on the Drawings, such items must be accurately located exactly as indicated.
3. Special care to be exercised in locating outlets symmetrically in ceiling panels and other structural features of the Building.
4. If so instructed by the Architect or Owner, the location of any outlet or outlets to be moved a distance not to exceed 5'-0" in any direction without additional cost, provided such instructions are given prior to the installation of such outlet or outlets.
5. Exact locations of motors to be determined with the HVAC Contractors. Do not rough-in for motors by scaling Electrical Drawings.
6. The exact location of floor outlets shall not be scaled from the Drawings, but verified in the field from the final equipment drawings or as determined by the Architect's representative in consideration of equipment layouts.

B. BUILT-IN WORK AND COORDINATION

1. Before installing work, this Contractor shall see that it does not interfere with clearances required by Code for finish on beams, columns, pilasters, walls or other structural or architectural members.
2. If Electrical work is installed in a manner that it later develops that the architectural design cannot be followed, Electrical Contractor to make changes as required by the Architect to permit the completion of the architectural work in accordance with the Drawings and Specifications.
3. Examine the Plumbing and HVAC Drawings to ensure that electrical work does not interfere with or will not be covered by plumbing equipment, heating units, pumps, motors, fans, radiation, etc.
4. Where electrical equipment is to be installed in areas with ductwork, piping and plumbing, the superintendents and foremen of the trades involved shall coordinate locations of all items prior to installation. Should this coordination be ignored, or relocation of items be necessary to provide code clearances, such relocation shall be done at no change in price.
5. It is the Contractor's responsibility to see that all equipment and apparatus that may require maintenance is made easily accessible. Although the location of the equipment may be shown on the Drawings, the construction of the structure, and the location of other equipment may disclose that location of equipment does not make its position readily accessible. Contractor to call the attention of the Architect to the condition before advancing the construction to a point where a change in the location would reflect additional cost.
6. Particular attention should be given to the above mentioned Drawings for changes made on those Drawings which are not reflected on the Electrical Drawings. Any changes necessary to work installed under this Contract which could have been avoided by the foregoing references, to be made and paid for by this Contractor.
7. This contractor to keep himself fully informed of progress of the construction and install all work that is concealed and built into the Building in sufficient time to ensure proper location without delays to work of other trades. Properly attend the electrical work during progress of building-in to prevent misalignment of and damages to electrical work.

1.15 CLEANING AND PAINTING

- A. Interiors of all conduits to be swabbed clean and dry before pulling wire.
- B. Interiors of enclosures to be cleaned of dirt and debris before installing trim or covers.
- C. Finished surfaces of equipment furnished and installed to be thoroughly cleaned of dirt. Scratches or damaged surfaces to be properly repaired and painted to match existing.
- D. Areas worked in to be cleaned of debris resulting from installation.
- E. Existing fixtures which are to be relocated and reused to be cleaned before rehang and be relamped with new lamps. Wipe all surfaces of fixture (inside and outside) and lens or louver.
- F. No finished painting except as noted below is required.
- G. Prime and paint all steel hangers, boxes, straps, rods, etc., furnished which are not provided with rust protective finish or if protective finish is damaged in installation. Primer to be quick-drying, rust-inhibitive, alkyd-based primer and finish coat to be semi-gloss, acrylic-latex, interior (or exterior, as applicable) enamel. This applies to unfinished and mechanical spaces and exposed-to-view locations.
- H. Finished surfaces of equipment furnished and/or installed which are scratched or skinned to be properly prepared for painting and touched up with type of paint used on original finish.
- I. Rust spots to be brushed clean, primed and painted with type of paint used on original finish.
- J. Wood mounting panels to have edges sanded to remove wood splinters and be non-combustible treated. Prime and paint with gray flameproof paint on both sides and edges before mounting.

1.16 CONCRETE WORK

- A. Furnish and install concrete work and accessories necessary for the following items:
 - 1. Concrete curbs at all surface conduits rising from floor slabs.
 - 2. Raised concrete bases for floor mounted transformers, building switchgear, ATS's and all other electric equipment as indicated on the Plans.
 - 3. All other items of concrete work hereinafter specified or noted on the plans.
 - 4. Concrete work to be in accordance with applicable sections of the American Concrete Institute's Standard Specifications for "Structural Concrete for Buildings" ACI 301-10 Concrete Reinforcing Steel Institute and the "Concrete" section of the General Contract Specifications.
 - 5. Concrete not exposed to weather to be 3000psi, 28 day test.
 - 6. Concrete exposed to weather to be 4000psi, 28 day, air entrained (6% to 12%).
 - 7. All bases and curbs to be neatly trowel-finished with chamfered or rounded edges.

PART 2 PRODUCTS

2.01 NOT USED.

PART 3 EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Armored cable.
- C. Metal-clad cable.
- D. Wiring connectors.

1.02 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.
- F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.
- G. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation); Federal Specification; Revision A, 2008.
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- I. NEMA WC 70 - Nonshielded Power Cable 2000 V or Less for the Distribution of Electrical Energy; 2009.
- J. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 4 - Armored Cable; Current Edition, Including All Revisions.
- M. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- N. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- O. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Most Recent Edition, Including All Revisions.
- P. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- Q. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- R. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- S. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
- T. UL 719 - Nonmetallic-Sheathed Cables; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. See Division 01 and Section 26 05 00 for submittal procedures and additional requirements.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Clearly mark shop drawings to indicate which items are being provided.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NEC.
- B. Provide products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NEC and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
 1. Exceptions:
 - a. MC cable may be used in existing drywall to serve devices and fixture whips less than 6'-0". See below for further details.

2.02 CONDUCTOR AND CABLE MANUFACTURERS

- A. Southwire Company: www.southwire.com.
- B. Okonite Company.
- C. General Cable
- D. Encore Wire Corporation

2.03 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NEC.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.
- H. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
- I. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
 - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
 - 2. Control Circuits: 14 AWG.
- J. Where conductor size is not indicated, size to comply with NEC but not less than applicable minimum size requirements specified.
- K. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 6 AWG and larger may have black insulation color coded using vinyl color coding electrical tape wrapped around conductors at all accessible locations.
 - 3. Color Code:
 - a. 480Y/277 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral/Grounded: White.
 - 5) Equipment Ground: Green
 - b. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - 5) Equipment Ground: Green
 - 4. Equipment Ground, All Systems: Green.
 - a. Travelers for 3-Way and 4-Way Switching: Pink.
 - 5. For 24V wiring, use blue for control wiring. For instrument wiring, use red as the positive and black as the negative.

2.04 SINGLE CONDUCTOR BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. All conductors shall be stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation, U.L. type:

1. Copper Secondary Voltage Feeder Wire, Size #1 and larger: Type THHN/THWN-2 or XHHW-2.
 - a. THHN/THWN-2, and XHHW wire insulation shall be rated 90 deg. C.
 - b. Contractor is cautioned that 60 deg. C. wire is not acceptable.
2. Copper General Use Building Wire, Size #6 and smaller: Type THHN/THWN or THHN/THWN-2.
 - a. Size 4 AWG and Larger: Type XHHW-2.
 - b. All wire insulation shall be rated 75 deg. C, except as noted otherwise.
 - c. Contractor is cautioned that 60 deg. C. wire is not acceptable.
 - d. Wire insulation shall be 90 deg. C, for all high ambient temperature location wiring including but not limited to;
 - 1) Circulating Pumps

2.05 ARMORED CABLE

- A. Manufacturers:
 1. AFC Cable Systems Inc: www.afcweb.com/#sle.
 2. Encore Wire Corporation: www.encorewire.com/#sle.
 3. Southwire Company: www.southwire.com/#sle.
 4. Okonite
 5. Pirelli Cable Corporation
- B. Description: NEC, Type AC cable listed and labeled as complying with UL 4, and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
 1. Size 10 AWG and Smaller: Solid.
 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type THHN.
- F. Grounding: Combination of interlocking armor and integral bonding wire.
- G. Armor: Steel, interlocked tape.

2.06 METAL-CLAD CABLE

- A. Manufacturers:
 1. AFC Cable Systems Inc: www.afcweb.com/#sle.
 2. Encore Wire Corporation: www.encorewire.com/#sle.
 3. Service Wire Co: www.servicewire.com/#sle.
 4. Southwire Company: www.southwire.com/#sle.
- B. Description: NEC, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
 1. Size 10 AWG and Smaller: Solid.
 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- F. Provide dedicated neutral conductor for each phase conductor where indicated or required.
- G. Grounding: Full-size integral equipment grounding conductor.
- H. Armor: Steel, interlocked tape.

2.07 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

- B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.
- C. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors 10 AWG and Smaller: Use plastic or nylon screw-on type connectors. Bakelite insulated connectors shall not be used.
 - 2. Copper Conductors 8 AWG and Larger: Use crimp type mechanical connectors insulated with electrical tape to 150% of the insulating value of the conductor insulation.
- D. Wiring Connectors for Terminations:
 - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
 - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 - 4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
 - 5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
 - 1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. Ideal Industries, Inc: www.idealindustries.com/#sle.
 - c. Approved equals.
- G. Push-in Wire Connectors: Rated 600 V, 221 degrees F.
 - 1. Manufacturers:
 - a. Ideal Industries, Inc: www.idealindustries.com/#sle.
 - b. Wago Corporation: www.wago.us/#sle.
 - c. Approved equals.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
 - 1. Manufacturers:
 - a. IlSCO: www.ilsco.com/#sle.
 - b. Thomas & Betts Corporation: www.tnb.com/#sle.
 - c. Approved equals.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
 - 1. Manufacturers:
 - a. IlSCO: www.ilsco.com/#sle.
 - b. Thomas & Betts Corporation: www.tnb.com/#sle.
 - c. Approved equals.

2.08 ACCESSORIES

- A. Electrical Tape:
 - 1. Manufacturers:
 - a. 3M: www.3m.com. Scotch No. 88. all temperature type
 - b. Or approved equal.
 - 2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.

3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
- B. Wire Pulling Lubricant:
 1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. Ideal Industries, Inc: www.idealindustries.com/#sle.
 - c. Approved equal.
 2. Listed and labeled as complying with UL 267.
 3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 4. Suitable for use at installation temperature.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NEC.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 2. When circuit destination is indicated without specific routing, determine exact routing required.
 3. Arrange circuiting to minimize splices.
 4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NEC.
 5. Maintain separation of wiring for emergency systems in accordance with NEC.
 6. Not more than three 120V branch circuits may be installed in a single conduit. Circuits to be installed on the basis of one multiwire single phase (A,B,C,N,G) or one 3 phase (A,B,C,G) circuit per conduit unless indicated otherwise.
 - a. Definition: A multiwire branch circuit consists of two or more ungrounded conductors that have a voltage between them, and a grounded conductor with equal voltage between it and each ungrounded conductor of the circuit and that is connected to the neutral or grounded conductor of the system.
 - b. All grounded and ungrounded conductors in a multiwire branch circuit shall be grouped together and secured with wire ties in the panelboard for easy identification.
 - c. Provide identified handle ties on single pole breakers with multiwire branch circuits to simultaneously disconnect all ungrounded conductors at the location where the circuit originates.
 7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
 - a. In no instance may a single neutral be used when two circuit wires are connected to the same phase bus of the panelboard.
 - b. Branch circuits with dimming controls.

8. Branch circuits to be connected as numbered on the drawings. Test and permanently tag by circuit number each circuit wire, except neutrals, in panelboard gutter before connecting to panelboard.
 9. Identified neutral conductors to be insulated throughout and grounded only as specified in Section 26 05 26.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. All wiring to be in conduit unless otherwise indicated.
- E. Install armored cable (Type AC) in accordance with NECA 120.
- F. Install metal-clad cable (Type MC) in accordance with NECA 120.
- G. Provide required support of MC cable per NEC.
- H. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer. Grease or petroleum base lubricants shall not be used.
- I. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- J. Where 4 AWG and larger conductors are installed in conduit 1-1/2" and smaller with non-insulating end bushings, provide "insuliners" around the conductors at the conduit end bushings.
- K. Secure and support conductors and cables in accordance with NEC using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- L. Terminate cables using suitable fittings.
1. Armored Cable (Type AC):
 - a. Use listed fittings and anti-short, insulating bushings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
 2. Stranded wire, #10 and smaller, shall be terminated with compression type self-insulating spade terminals where they are connected to devices or equipment under screw or bolt heads or under bolt and nut.
 3. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- M. Install conductors with a minimum of 6 inches of slack at each outlet.
- N. Where conductors are installed in enclosures for future termination, provide a minimum of 5 feet of slack.
- O. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

- P. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- Q. Make wiring connections using specified wiring connectors.
 - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies.
 - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 - 3. Do not remove conductor strands to facilitate insertion into connector.
 - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
 - 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
 - 7. Make splices, taps and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- R. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- S. All conduits in which conductors are not installed shall have a #12 THW pull-wire provided.
- T. Insulate ends of spare conductors using vinyl insulating electrical tape.
- U. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- V. Identify conductors and cables in accordance with Section 26 05 53.
- W. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, as required for a complete operating system.
- X. Cords for make-up connections to various appliances or to equipment to be 600V, heat resistant, rubber insulated, portable cable with neoprene jacket U.L. type "SO" and "STO". Cords to be extra flexible stranded copper. Three-conductor to be used for two-conductor requirements with third conductor used for equipment frame ground. Four-conductor to be used for three-conductor requirements to appliance with fourth conductors

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.

1.02 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. See Division 01 and Section 26 05 00 for submittal procedures and additional requirements.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- C. Shop Drawings:
 - 1. Clearly mark shop drawings to indicate which items and any options that are being provided.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NEC.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NEC and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NEC but not less than applicable minimum size requirements specified.

1. NEC Table 250.122 for minimum equipment grounding conductor size
2. NEC Table 250.66 for minimum service entrance and separately derived systems grounding conductor size
- E. Bonding and Equipment Grounding:
 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NEC.
 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NEC.
 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) bus.
 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
 1. Use insulated copper conductors unless otherwise indicated.
 2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.
 3. Manufacturers -
 - a.
 - b. General Cable Corporation
 - c. Rome Cable Company
- C. Connectors for Grounding and Bonding:
 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Manufacturers - Mechanical and Compression Connectors:
 - a. O.Z. / Gedney, Division of General Signal Corporation
 - b. Burndy Corporation
 - c. approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Make grounding and bonding connections using specified connectors.
 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.

2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
- D. The grounded circuit conductors (neutral) of the system to be electrically continuous throughout and grounded only in the service entrance equipment (switchboard, panel, switch, etc.) or as a separately derived system at a transformer.
- E. Identify grounding and bonding system components in accordance with Section 26 05 53.
- F. The equipment grounding conductor shall connect to the metallic conduit system in every enclosure (panelboard, junction, outlet, switch and pull boxes, motor terminal box and any other metallic enclosure). In all boxes grounding conductor shall be connected together and pigtail connected to the enclosure under a separate screw in threaded ground tap and to devices where they occur. In panelboards connect to ground bus.
- G. In no instance may "green ground" equipment grounds be connected to a neutral conductor. In those instances where "green grounds" are wired from a panel, those grounds to terminate at the panelboard equipment ground bus.
- H. Flexible conduit shall not to be considered as a grounding path. All flexible conduit shall have a green ground wire inside the conduit sized per NEC.
- I. The secondary neutrals of transformers to be grounded in the following manner:
 1. The secondary neutral terminal of the transformer to be connected to the metal case lug of the transformer. Size according to NEC based on secondary phase conductors
 2. The secondary neutral terminal to be grounded by a green grounding electrode conductor (code size for secondary line conductors) connected to a grounding electrode.
- J. All locknuts at enclosures to make tight contact with the enclosure. Remove paint from enclosures under locknuts. Where positive electrical continuity at enclosures cannot be obtained, then conduits shall be bonded to the enclosure.
- K. Metallic conduits containing only ground wires to have ground wires bonded to the conduit at each end.
- L. Separate ground conductors or conduits containing only ground wires shall not be installed through metallic sleeves and shall not be completely encircled by metallic supports, hanger or similar enclosures.
- M. An equipment grounding conductor (green ground wire) to be installed with all circuits over 100 volts. Minimum size #12 green ground.
- N. All appliances to be positively grounded to the metallic conduit system by green braid ground wires, either as a part of a cord assembly or by separate wire. In no instance may the neutral conductor serve as an equipment ground.
- O. Install a green pigtail from grounding lug of all grounding type outlets to outlet box so that the connection to the box is positive even when the device is removed to 6 inches from the box.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2013.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
 - 2. Coordinate work to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
 - 4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
 - 5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 30 00.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.
- B. Shop Drawings: Include details for fabricated hangers and supports. Clearly mark shop drawings to indicate which items and any options that are being provided.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Conform to requirements of NEC.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Comply with the following. Where requirements differ, comply with most stringent.
 - a. NFPA 70.
 - b. Requirements of authorities having jurisdiction.
 - 2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
 - 3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
 - 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 5. Do not use products for applications other than as permitted by NEC and product listing.
 - 6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 - 7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
 - 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 - 2. Conduit Clamps: Bolted type unless otherwise indicated.
- C. Metal Channel/Strut Framing Systems:
 - 1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
 - 2. Comply with MFMA-4.
 - 3. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
 - 4. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
 - 5. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.
 - 6. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Thomas & Betts Corporation: www.tnb.com/#sle.
 - c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
- D. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
 - 1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2-inch diameter.
 - b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.
 - c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.
 - d. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
 - e. Outlet Boxes: 1/4-inch diameter.
 - f. Luminaires: 1/4-inch diameter.
- E. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
2. Concrete: Use preset concrete inserts or expansion anchors. Provide adequate type anchors approved for specific application and in compliance with manufacturer's allowable shear and tension values.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts or hollow wall fasteners.
5. Hollow Stud Walls: Use toggle bolts or hollow wall fasteners.
6. Steel: Use beam clamps or welded threaded studs.
 - a. Beam Clamps: Provide PHD, Fig.610 beam clamps with Fig. 35 eye nut for all supports from beams.
 - b. "C" Clamps: Provide PHD Fig. 250 "C" clamp with Fig. 259 retaining clip for all supports from steel bar joists. "C" clamps without retaining clips are prohibited.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Friction type clips of any type are prohibited.
11. The use of perforated steel strap supports is prohibited.
12. Powder-actuated fasteners are not permitted.
13. Hammer-driven anchors and fasteners are not permitted.
14. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
 - b. Comply with MFMA-4.
 - c. Channel Material: Use galvanized steel.
 - d. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
 - e. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
15. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that mounting surfaces are ready to receive support and attachment components.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1.
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. All supports shall be designed to avoid interference with other piping, hangers, conduits and supports, building structures and equipment.
- E. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- F. All conduit and equipment must be supported from the building structure and in no case may anything be supported from the ceiling grid system.
- G. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- H. Do not penetrate or otherwise notch or cut structural members without approval of Architect.
- I. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1 and per the manufacturer's requirements. Choose the head style and shape best suited for each location.

- J. Equipment Support and Attachment:
 - 1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
 - 2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized concrete pad 3 inches in height; see Section 03 30 00.
 - 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
 - 6. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- K. Supports hung from steel structure:
 - 1. Supports hung from beams: Provide beam clamps to suit beams installed.
 - 2. Supports hung from bar joists: Provide "C" clamps with retaining clips to suit joists and decking installed. Where required, this Contractor shall furnish and install proper angles or channels between joists for hanger supports. Secure members to joists with bolts or clamps, welding to be done only by specific approval of the Architect/Engineer.
 - 3. The use of "C" clamps without retaining clips is not permitted.
- L. Supports to be placed as each offset or change in direction, at the ends of the branches, and at risers.
- M. The contractor shall bear all responsibility for materials and workmanship as described in this section, and shall make sure that all hangers and supports are properly and permanently connected to building structure. Anchors shall be attached to rigid structural element with no additional support as necessary to prevent movements in any direction (including rotational movement). The Contractor shall design and install anchors to suit job conditions.
- N. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- O. Anchor bolts set in concrete floors, pads or decks shall be installed in strict accordance with the manufacturer's recommendations using proper size and type drill bits.
- P. Supports from concrete structure shall be in strict accordance with the fastener manufacturer's allowable shear and tension values. Use proper size and type drill bits as specified in fastener installation instructions.
- Q. Secure fasteners in accordance with manufacturer's recommended torque settings.
- R. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- S. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 33.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Aluminum rigid metal conduit (RMC).
- C. Galvanized steel intermediate metal conduit (IMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Galvanized steel electrical metallic tubing (EMT).
- G. Aluminum electrical metallic tubing (EMT).
- H. Conduit fittings.

1.02 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
- B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2005.
- D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
- G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.
- H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.
- I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
- J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- N. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.
- O. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- P. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- Q. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- R. UL 797A - Electrical Metallic Tubing - Aluminum and Stainless Steel; Current Edition, Including All Revisions.
- S. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- T. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
 - 2. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
 - 3. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- B. Shop Drawings: Clearly mark shop drawings to indicate which items and any options that are being provided.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NEC.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NEC and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- C. Full weight, rigid steel metallic conduit to be installed at all locations except at specified optional locations. Rigid conduit to have threaded couplings and terminations. Use aluminum conduit where exposed outdoors above grade.
- D. Intermediate Metal Conduit (IMC) may be used in place of full weight rigid galvanized where permitted by code.
- E. Contractor may option the use of electrical metal tubing (EMT). EMT is allowed to be aluminum EMT. Maximum 4" for any use listed below. EMT may only be used at the following locations:
 - 1. In interior partitions.
 - 2. Exposed work on exposed ceilings.
 - 3. Exposed work on walls above 8'-0".
 - 4. In built-in cabinet work
 - 5. Above suspended ceilings.
- F. Electrical metal tubing may not be installed for exterior use, in exterior walls, in concrete slabs, in ground below concrete slabs, entrance for electrical service, distribution system feeders, plumbing or heating and air conditioning equipment feeders, plumbing or heating and air conditioning equipment branch circuits or corrosive and hazardous locations.
- G. Liquid-tight flexible conduit to be used in place of flexible metallic conduit where exposed to moisture, grease, oil or other dirt.
- H. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
 - 1. Maximum Length: 6 feet.
 - 2. Minimum size 1/2"
- I. Flexible Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
 - 3. Maximum Length: 6 feet unless otherwise indicated.
 - 4. Minimum size 3/4"
 - 5. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.

- J. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

2.02 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70.
- B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.
- C. Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.
- D. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- E. Provide products listed, classified, and labeled as suitable for purpose intended.
- F. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 3/4-inch trade size.
 - 2. Branch Circuit Homeruns: 3/4-inch trade size.
 - 3. Control Circuits: 1/2-inch trade size.
 - 4. Flexible Connections to Luminaires: 3/8-inch trade size.
- G. Where conduit size is not indicated, size to comply with NEC but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 - 3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
- B. Description: NEC, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
 - 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
 - 2. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 - 3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 - 3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
- B. Description: NEC, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.
- C. Fittings:
 - 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
 - 2. Material: Use aluminum.
 - 3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.

3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
- B. Description: NEC, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
 2. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.06 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:
 1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
 2. Electri-Flex Company: www.electriflex.com/#sle.
 3. International Metal Hose: www.metalhose.com/#sle.
- B. Description: NEC, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used. Interlocked steel construction.
- C. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.

2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
 1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
 2. Electri-Flex Company: www.electriflex.com/#sle.
 3. International Metal Hose: www.metalhose.com/#sle.
- B. Description: NEC, Type LFMC polyvinyl chloride (PVC) jacketed aluminum flexible metal conduit listed and labeled as complying with UL 360. Interlocked aluminum construction with PVC jacket.
- C. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.

2.08 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 2. Nucor Tubular Products: www.nucortubular/#sle.
 3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
- B. Description: NEC, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 3. Connectors and Couplings: Use compression/gland or set-screw type.
 - a. Do not use indenter type connectors and couplings.
 4. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

2.09 ALUMINUM ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT aluminum electrical metallic tubing listed and labeled as complying with UL 797A.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; listed for use with aluminum EMT.
 - 2. Material: Use aluminum.
 - 3. Connectors and Couplings: Use compression/gland or set-screw type.
 - a. Do not use indenter type connectors and couplings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that mounting surfaces are ready to receive conduits.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- F. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. Conduit work to be generally concealed above ceilings, in walls, or below floor. In areas without finished ceilings, conduit work to be generally exposed at ceilings, concealed in walls or below floor.
 - 3. Conceal conduits unless specifically indicated to be exposed.
 - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Within joists in areas with no ceiling.
 - 5. Exposed conduit work shall be laid out and installed in neat and workmanlike manner without runs diagonal to the Building walls. Extreme care to be taken to coordinate location of exposed conduits and boxes with piping and ductwork. Conduits to be installed above Plumbing pipes and ductwork wherever possible.
 - 6. Lay out conduit system to avoid crossing Building expansion joints insofar as possible. Where crossings are necessary, use telescoping type expansion fittings, O.Z. type "AX" for through run of conduit or "EXE" end type for expansion joints with grounding continuity.
 - 7. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 - 8. Arrange conduit to maintain adequate headroom, clearances, and access.
 - 9. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
 - 10. Route conduits above water and drain piping where possible.
 - 11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
 - 12. Horizontal runs of conduit not permitted in masonry walls.
- G. Conduit Support:
 - 1. Secure and support conduits in accordance with NEC and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.

2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 4. Use one-hole malleable conduit strap or beam clamp to support single surface-mounted conduit.
 - a. Neatly offset supports at knockout entrances to surface boxes to flat surfaces.
 - b. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
 5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
 6. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
 7. Use of wire for support of conduits is not permitted.
 8. Where conduit support intervals specified in NEC and NECA standards differ, comply with the most stringent requirements.
- H. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Threaded couplings shall be screwed tight at all points. Running threads are prohibited. Conduit system to be electrically continuous for permanent low resistance grounding.
 4. Use suitable adapters where required to transition from one type of conduit to another.
 5. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 6. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 7. All conduits entering boxes or enclosures are to be threaded, and locknuttied on each side of the enclosure and be provided with an end bushing installed inside the enclosure.
 8. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
 9. Secure joints and connections to provide mechanical strength and electrical continuity.
- I. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 4. Conduits penetrating floor slabs (except slab-on-grade) to be encased at the floor line with a 3" high concrete curb with chamfered edges.
 5. Conceal bends for conduit risers emerging above ground.
 6. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 13.
- J. Junction boxes to be accessible, coordinate with other trades
- K. Conduit bends to be neatly formed with tools specifically designed for use to prevent deformation of internal diameter of conduit.
- L. In partitions constructed of studs and drywall, all devices shall be supplied from an overhead conduit system.
- M. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where conduits are subject to earth movement by settlement or frost.
- N. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at accessible point near penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- O. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed in the future. Leave minimum slack of 12 inches at each end.
- P. Provide grounding and bonding; see Section 26 05 26.
- Q. A ground wire shall be installed in all flexible conduit.
- R. Identify conduits; see Section 26 05 53.

3.03 FITTINGS

- A. Liquid-tight flexible metallic conduit fittings to be reusable type with screw-in ferrule.
- B. Bushings for metallic conduit to be metal bushings with nylon insulated throat.
- C. Conduits to be connected and terminated with approved fittings (connectors, couplings, bushings, locknuts, etc.) matching box and conduit type, see conduit specification section.
- D. All fittings where conduits terminate in an enclosure (box, panel, switchboard, etc.) and stub out ends to be equipped with nylon insulating surface to prevent conductor insulation damage.

3.04 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

END OF SECTION

SECTION 26 05 33.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
- E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
- F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NEC.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other Divisions.
 - 4. Coordinate the work with other trades to preserve insulation integrity.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for outlet and device boxes and cabinets and enclosures. Clearly mark shop drawings to indicate which items and any options that are being provided.
- B. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NEC.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NEC and product listing.
 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 4. Where box size is not indicated, size to comply with NEC but not less than applicable minimum size requirements specified.
 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 2. Use cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 3. Use cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
 4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
 5. Use suitable concrete type boxes where flush-mounted in concrete.
 6. Use raised covers suitable for the type of wall construction and device configuration where required.
 7. Do not use "through-wall" boxes designed for access from both sides of wall.
 8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 10. Boxes for Supporting Luminaires: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 12. Minimum Box Size, Unless Otherwise Indicated:
 - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
 - b. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
 13. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
 - c. Appleton, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
 - d. Thomas & Betts Corporation: www.tnb.com/#sle.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 - a. Indoor Clean, Dry Locations: Type 1, painted steel.
 - b. Outdoor and Damp Locations: Type 3R, painted steel.
 3. Junction and Pull Boxes Larger Than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 - b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
 4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
 - a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.

- b. Back Panels: Painted steel, removable.
- 5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
- 6. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
 - c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that mounting surfaces are ready to receive boxes.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Furnish and install boxes and associated fittings as described herein and as indicated on the drawings and also those required for easy pulling of conductors, splices, taps and equipment connections. Installation shall be consistent with good workmanship and as required by NEC.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NEC.
- E. Provide separate boxes for emergency power and normal power systems.
- F. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- G. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- H. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- I. Box Locations:
 - 1. All boxes to be installed so they are accessible, coordinate with all equipment and features of the Building. Provide access doors in ceilings, walls, etc. as required.
 - 2. Unless dimensioned, box locations indicated are approximate.
 - 3. Locate boxes as required for devices installed under other Divisions.
 - 4. Locate boxes so that wall plates do not span different building finishes.
 - 5. Locate boxes so that wall plates do not cross masonry joints. In unplastered concrete block walls, adjust outlet heights to coursing of block. Adjustment to allow for plate overlap of box. Plates shall not overlap tooled block joint.
 - 6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
 - 8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
 - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
 - 9. Locate junction and pull boxes as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points.

10. Coordinate mounting heights and locations of items mounted above counters, benches, backsplashes and other architectural features with Architect prior to rough-in
 11. Outlet heights given below are general only and adjustments will be necessary to coordinate with the locations of equipment and furnishings. All outlets dimensioned from the finished floor to centerline of outlet. Unless otherwise noted on Drawings or required by job conditions, outlet heights to be as follows:
 - a. Switch height: 46" unless otherwise noted on drawings or required for coordination with equipment or furnishings.
 - b. Convenience outlets: 18" unless otherwise noted on Drawings or required for coordination with equipment or furnishings.
 - c. Panelboards: 72" to top of cabinet.
 - d. For outlet height of wall lighting brackets, refer to the Drawings.
- J. Box Supports:
1. Secure and support boxes in accordance with NEC and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide independent support from building structure, and conduit system, . Do not provide support from piping, ductwork, or other systems.
 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
 4. In metal stud and drywall type construction, boxes shall be installed so both sides of the box are secured and the box is rigidly supported between two studs. Caddy RBS series bracket or approved equal.
- K. Install boxes plumb and level.
- L. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 2. Extension rings to be used on boxes which cannot otherwise be installed within 1/4" of finish surfaces.
 3. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 4. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- M. Install boxes as required to preserve insulation integrity.
- N. Where outlet, junction or pull boxes are to be cast in concrete slabs, they shall be boxes designed for concrete installation.
- O. Multiple voltage boxes to have dividers separating different voltage.
- P. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 13.
- R. Disconnect switches or motor starters are not to be used for junction boxes. Furnish necessary boxes and wiring gutters external to disconnect switches and motor starters.
- S. Close unused box openings.
- T. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use. All junction and pull boxes to have galvanized blank screw or hinged covers installed before completion of the work.
- U. All knockouts opened and left unused to be closed with snap-in knockout closers.

- V. Carefully refer to the Architectural room treatment schedule for proper selection of boxes in accord with this specification section. Carefully refer to the room dimensions and door swings on Architectural Drawings for location of outlets. In event of discrepancy with the Drawings, the Architectural Drawings shall govern.
- W. In addition to the reference above, constantly refer to the Structural, Plumbing, Fire Protection, and HVAC Drawings for conflicts in those systems with the location of any and all outlets. Conflicts resulting from failure to make such references to be corrected at this Contractor's expense.
- X. Provide grounding and bonding in accordance with Section 26 05 26.
- Y. Identify boxes in accordance with Section 26 05 53.

3.03 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

END OF SECTION

SECTION 26 05 33.23 - SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wireways.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2023
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- E. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.
- F. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of existing raceways with millwork, furniture, equipment, etc.
 - 2. Coordinate rough-in locations of outlet boxes provided under Section 26 05 33.16 and conduit provided under Section 26 05 33.13 as required for installation of raceways provided under this section.
 - 3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install raceways until final surface finishes and painting are complete.
 - 2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
- B. Samples: One of each type and color of surface raceway system specified, 6 inches in length.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

- A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.02 WIREWAYS

- A. Manufacturers:
 - 1. Cooper B-Line, a division of Cooper Industries: www.cooperindustries.com/#sle.
 - 2. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
 - 3. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- B. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.
- C. Wireway Type, Unless Otherwise Indicated:
 - 1. Indoor Clean, Dry Locations: NEMA 250, Type 1, painted steel with hinged cover, secured with screws.
 - 2. Outdoor Locations: NEMA 250, Type 3R, painted steel with hinged cover, secured with screws.
- D. Finish for Painted Steel Wireways: Manufacturer's standard grey unless otherwise indicated.
- E. Minimum Wireway Size: 4 by 4 inches unless otherwise indicated.
- F. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that outlet and device boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.
- B. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Prior to installation, layout the exact route of surface mounted raceway in coordination with all existing conditions. Installer shall comply with detailed manufacturer's instruction sheets which accompany system components as well as complete system instruction sheets.
- B. Install products in accordance with manufacturer's instructions.
- C. Install surface mounted raceways and wireways in a neat and workmanlike manner in accordance with NECA 1.
- D. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.
- E. All raceway systems shall be installed complete, including insulating bushings and inserts where required.
- F. Provide grounding and bonding in accordance with Section 26 05 26.
- G. Identify raceways in accordance with Section 26 05 53.

3.03 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.04 PROTECTION

- A. Protect installed raceways from subsequent construction operations.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Panel Directories

1.02 REFERENCE STANDARDS

- A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NFPA 70E - Standard for Electrical Safety in the Workplace; 2015.
- D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
 - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 2. Do not install identification products until final surface finishes and painting are complete.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NEC.

1.05 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Existing Work: Unless specifically excluded, identify existing elements to remain whose designations are changed as part of the new work.
- B. Identification for Equipment:
 - 1. Provide identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Panelboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location.
 - 4) Identify main overcurrent protective device. Use identification nameplate for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
 - 5) Use typewritten circuit directory to identify load(s) served by panelboards. Identify spares and spaces.
 - b. Transformers:
 - 1) Identify kVA rating.
 - 2) Identify voltage and phase for primary and secondary.
 - 3) Identify power source and circuit number. Include location.
 - 4) Identify load(s) served. Include location when not within sight of equipment.

- c. Enclosed safety switches and motor controllers:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
- 2. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
- 3. Use identification nameplate on inside of door at each fused switch to identify required NEMA fuse class and size.
- 4. Use identification label on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
- 5. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
- 6. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
 - a. Service equipment.
- 7. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
 - a. Minimum Size: 3.5 by 5 inches.
 - b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
- 8. Equipment designations shall be as scheduled and shown on Architectural, Plumbing, Fire Protection, HVAC, and Electrical Drawings.
- 9. Room numbers as assigned may or may not be per Drawings. Verify with Architect prior to finalizing labels.
- C. Identification for Conductors and Cables:
 - 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
 - 2. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
 - a. At each source and load connection.
 - b. Within boxes.
 - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
 - d. In cable tray, at maximum intervals of 20 feet.
 - 3. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
- D. Identification for Boxes:
 - 1. Use color coded boxes to identify systems other than normal power system.
 - a. Color-Coded Boxes: Field-painted in accordance with Section and per the same color code used for raceways.
 - 1) Fire Alarm System: Red.
 - 2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
- E. Identification for Devices:
 - 1. Identification for Communications Devices: Comply with Section 27 10 00.
 - 2. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 - 1. Manufacturers:
 - a. Brady Corporation
 - b. Brimar Industries, Inc: www.brimar.com/#sle.
 - c. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - d. Seton Identification Products: www.seton.com/#sle.
 - e. Approved Equal.
 - 2. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic nameplates suitable for exterior use.
 - 3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
 - a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
 - 4. Nameplates shall have black front and back with white core with lettering etched through front layer. Minimum letter height of 3/16".
 - 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
 - 1. Manufacturers:
 - a. Brady Corporation: www.bradyid.com/#sle.
 - b. Brother International Corporation: www.brother-usa.com/#sle.
 - c. Panduit Corp: www.panduit.com/#sle.
 - d. Approved Equal.
 - 2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - a. Use only for indoor locations.
 - 3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

2.03 WIRE AND CABLE MARKERS

- A. Manufacturers:
 - 1. Brady Corporation: www.bradyid.com/#sle.
 - 2. HellermannTyton: www.hellermannntyton.com/#sle.
 - 3. Panduit Corp: www.panduit.com/#sle.
 - 4. Approved Equal.
- B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth or wrap-around self-adhesive vinyl self-laminating type markers suitable for the conductor or cable to be identified.
- C. Markers shall be oil, abrasion and water resistant.
- D. Legend: Power source and circuit number or other designation indicated.
- E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- F. Minimum Text Height: 1/8 inch.
- G. Color: Black text on white background unless otherwise indicated.

2.04 PANELBOARD DIRECTORIES

- A. Provide a directory in each panelboard. Directories shall be type-written, hand-written directories are not acceptable.
- B. Panelboard directories shall include all field changes, room numbers as assigned by Architect and the installation date.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 - 1. Surface-Mounted Equipment: Enclosure front.
 - 2. Flush-Mounted Equipment: Inside of equipment door.
 - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 - 4. Elevated Equipment: Legible from the floor or working platform.
 - 5. Interior Components: Legible from the point of access.
 - 6. Conduits: Legible from the floor.
 - 7. Boxes: Outside face of cover.
 - 8. Conductors and Cables: Legible from the point of access.
 - 9. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
 - 1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Mark all handwritten text, where permitted, to be neat and legible.
- G. Conductors to be identified at source with wire markers stating circuit number (Ex. 34, 42) and at all intervening pullboxes and junction boxes between its source and load stating source and circuit number (Ex. LPA-25, MMC-10).
- H. Panelboard directories to be complete and typewritten to indicate type of load served and location. If circuit is spare or space, indicate so.
- I. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.
- J. Install nameplates parallel to equipment lines and generally on the front cover, at the top and centered.

END OF SECTION

SECTION 26 05 55 - ELECTRICAL SLEEVES AND FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sleeves and fire stopping for penetrations of partitions, floors, and roofs.
- B. Firestopping materials.
- C. Firestopping of all penetrations and interruptions to fire rated assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 REFERENCE STANDARD

- A. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2005a.
- B. ASTM E 814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2002.
- C. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- D. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

- A. See Division 01 and Section 26 05 00 for submittal procedures and additional requirements
- 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 Catalog cuts and manufacturer's specification sheets for and data on product characteristics, performance ratings, and limitations.

1.04 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs which provide the specified fire ratings when tested in accordance with methods indicated, ASTM E 814, and ASTM E 119.
 - 1. Listing in the current-year classification or certification books of UL or FM will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Stop System
 - 1. Hilti USA
 - 2. Tremco
 - 3. Nelson Firestop Products
 - 4. Flame Stop, Inc.
 - 5. 3M Fire Protection Products
- B. Pipe Curb Assemblies
 - 1. Thybar Corp.
 - 2. The Pate Company

2.02 SLEEVES

- A. Conduit sleeves are to be standard weight black steel pipe, machine cut. Sleeves are to be sized to allow not less than 1/4" clearance around conduit.
- B. Sleeves through walls are to be of a length equal to wall thickness. Sleeves through floors are to extend 1-1/2" above finished floor. Sleeves through waterproof floors are to have a clamping ring and project minimum of 4" above finished floor line.
- C. Pipe Curb Assembly - Galvanized steel construction with wood nailer, 1-1/2" thick fiberglass board insulation, acrylic clad ABS thermo plastic cover with graduated step neoprene boot(s) with stainless steel band clamps. Hole size and arrangement as required.
- D. Pipe Seal - Spun aluminum base with surface flange, graduated step neoprene boot and stainless steel clamps.

2.03 FIRESTOPPING

- A. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. For penetrations by non-combustible items including steel pipe, rigid steel conduit and electrical metallic tubing (EMT), the following materials are acceptable:
 - 1. Hilti FS 601 Elastomeric Firestop Sealant
 - 2. Hilti FS-ONE High Performance Intumescent Firestop Sealant.
 - 3. 3M Fire Stop Sealant 2000
 - 4. 3M Fire Barrier CP25 WB
 - 5. Tremco Tremstop Fyre-Sil Sealant
- C. For penetrations by combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems), the following materials are acceptable:
 - 1. Hilti FS-ONE High Performance Intumescent Firestop Sealant
 - 2. Hilti CP 642 Firestop Jacket
 - 3. Hilti CP 643 Firestop Jacket
 - 4. 3M Fire Barrier CP25 WB
 - 5. 3M Fire Barrier FS-195 Wrap/Strip
 - 6. Tremco Tremstop WBM Intumescent Firestop Sealant
- D. For penetrations by combustible plastic conduit, the following materials are acceptable:
 - 1. Hilti CP 642 Firestop Jacket
 - 2. Hilti CP 643 Firestop Jacket
 - 3. Hilti FS-ONE High Performance Intumescent Firestop Sealant.
 - 4. 3M Fire Barrier PPD Plastic Pipe Device
- E. For large size/complex penetrations made to accommodate cable trays, multiple conduits or electrical busways, the following materials are acceptable:
 - 1. Hilti FS 635 Trowelable Firestop Compound
 - 2. Hilti FIRE BLOCK
 - 3. 3M Firestop Foam 2001
 - 4. 3M Fire Barrier CS-195 Composite Sheet
- F. For penetrations through concrete floors and ceilings the following materials are required:
 - 1. 2-hr fire rated link-seal (see detail on drawing E4.1)

PART 3 EXECUTION

3.01 SLEEVES

- A. Provide sleeves for all conduits passing through walls and floors.
- B. Conduit penetrations through roof are to be sleeves which extend a minimum of 12" above the finished roofs.

- C. Fill space between conduit sleeve and wall with materials normally used in conjunction with wall construction.
- D. Spare sleeves through walls are to be capped at both ends.
- E. Provide pipe curb assembly for multiple conduits, provide pipe seal for individual conduits. Install per manufacture's requirements.

3.02 FIRESTOPPING

- A. Provide a firestop system with an "F" Rating as determined by UL1479 of ASTM E814 which is equal to the time rating of construction being penetrated.
- B. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction being penetrated.
- C. Provide protection to prevent firestopping from contacting adjoining surfaces that will remain exposed and that would be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials.
- D. Identify firestopping with labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestopping installation where the labels will be visible to anyone seeking to remove penetrating items or firestopping.
- E. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, conduits and other penetrating items.
- F. Penetrations through smoke or fire-resistance-rated walls and partitions including both empty openings and openings containing cables, conduits and other penetrating items.
- G. Penetrations through concrete and masonry construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.

3.03 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.04 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
- B. Remove incompatible materials which may affect bond.
- C. Install backing materials to arrest liquid material leakage.

END OF SECTION

SECTION 26 05 83 - WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical connections to equipment.

1.02 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
 - 2. Determine connection locations and requirements.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NEC.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
 - 1. Colors: Comply with NEMA WD 1.
 - 2. Cord Construction: NEC, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
 - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

- J. All items shall be effectively grounded and connected to comply with the NEC. The neutral conductor shall not be used for grounding. All connections shall include a green equipment grounding conductor. See section 26 05 26 for additional requirements.

END OF SECTION

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Occupancy sensors.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- D. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2011.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other Divisions.
 - 2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
 - 3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other Divisions.
 - 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
 - 1. Do not install lighting control devices until final surface finishes and painting are complete.

1.04 SUBMITTALS

- A. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
 - 1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.
- B. Shop Drawings:
 - 1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
- C. Field Quality Control Reports.
- D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Operation and Maintenance Data: Include detailed information on device programming and setup.
- F. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.07 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

- A. Provide five year manufacturer warranty for all occupancy sensors.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.
- C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.02 OCCUPANCY SENSORS

- A. Manufacturers:
 - 1. WattStopper: www.wattstopper.com.
 - 2. Lutron Electronics Company, Inc: www.lutron.com/#sle.
 - 3. Sensor Switch Inc: www.sensorswitch.com/#sle.
 - 4. Green Gate.
 - 5. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- B. All Occupancy Sensors:
 - 1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
 - 2. Sensor Technology:
 - a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
 - b. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.
 - 3. Provide LED to visually indicate motion detection.
 - 4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
 - 5. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
 - 6. Sensitivity: Field adjustable.
 - 7. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
 - 8. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
 - 9. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

- C. Wall Switch Occupancy Sensors:
 - 1. All Wall Switch Occupancy Sensors:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
 - b. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
 - c. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
 - d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
 - e. Finish: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated. Confirm with Architect.
- D. Ceiling Mounted Occupancy Sensors:
 - 1. All Ceiling Mounted Occupancy Sensors:
 - a. Description: Low profile occupancy sensors designed for ceiling installation.
 - b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
 - c. Provide field selectable setting for disabling LED motion detector visual indicator.
 - d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
 - e. Finish: White unless otherwise indicated.
 - 2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 - 3. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 1000 sqft at a mounting height of 9 feet, with a field of view of 360 degrees.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
- E. Power Packs for Low Voltage Occupancy Sensors:
 - 1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
 - 2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
 - 3. Input Supply Voltage: Dual rated for 120/277 V ac.
 - 4. Load Rating: As required to control the load indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- B. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- C. Verify that final surface finishes are complete, including painting.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- E. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Install lighting control devices in accordance with manufacturer's instructions.
- C. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- D. Install lighting control devices plumb and level, and held securely in place.
- E. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26.
- F. Provide required supports in accordance with Section 26 05 29.
- G. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- H. Occupancy Sensor Locations:
 - 1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.
 - 2. Locate dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
- I. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.
- J. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.
- K. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.04 FIELD QUALITY CONTROL

- A. Inspect each lighting control device for damage and defects.
- B. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- C. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.
- C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of training.
 - 3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
 - 4. Location: At project site.

END OF SECTION

SECTION 26 22 00 - LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General purpose transformers.

1.02 REFERENCE STANDARDS

- A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers; Current Edition.
- B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers; 2015.
- C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers; 2013.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2015.
- F. NEMA ST 20 - Dry Type Transformers for General Applications; 2014.
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.
- K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
 - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
- B. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Maintenance Data: Include recommended maintenance procedures and intervals.
- E. Project Record Documents: Record actual locations of transformers.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.07 FIELD CONDITIONS

- A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
 - 1. Greater than 10 kVA: 104 degrees F maximum.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.geindustrial.com/#sle.
- B. Eaton Corporation: www.eaton.com/#sle.
- C. SQ D.
- D. Siemens Industry, Inc: www.usa.siemens.com/#sle.
- E.

2.02 TRANSFORMERS - GENERAL REQUIREMENTS

- A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.
- B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
 - 1. Altitude: Less than 3,300 feet.
 - 2. Ambient Temperature:
 - a. Greater than 10 kVA: Not exceeding 104 degrees F.
- C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.
- D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
- E. Basic Impulse Level: 10 kV.
- F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- G. Isolate core and coil from enclosure using vibration-absorbing mounts.

- H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 GENERAL PURPOSE TRANSFORMERS

- A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
- B. Primary Voltage: 480 volts delta, 3 phase.
- C. Secondary Voltage: 208Y/120 volts, 3 phase.
- D. Insulation System and Allowable Average Winding Temperature Rise:
 - 1. 15 kVA and Larger: Class 220 degrees C insulation system with 115 degrees C average winding temperature rise.
- E. Coil Conductors: Continuous copper windings with terminations brazed or welded.
- F. Winding Taps:
 - 1. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
- G. Energy Efficiency: Comply with 10 CFR 431, Subpart K.
- H. Sound Levels: Standard sound levels complying with NEMA ST 20.
- I. Mounting Provisions:
 - 1. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
- J. Transformer Enclosure: Comply with NEMA ST 20.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor clean, dry locations: Type 1.
 - 2. Construction: Steel.
 - a. 15 kVA and Larger: Ventilated.
 - 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
 - 4. Provide lifting eyes or brackets.
- K. Accessories:
 - 1. Mounting Brackets: Provide manufacturer's standard brackets.
 - 2. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

2.04 SOURCE QUALITY CONTROL

- A. Factory test transformers according to NEMA ST 20.
- B. Sound Level Tests: Perform factory test designated in NEMA ST 20 as "design" test on each production unit.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
- B. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install transformers in accordance with NECA 409 and IEEE C57.94.
- D. Use flexible conduit, under the provisions of Section 26 05 33.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

- E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
- F. Install transformers plumb and level.
- G. Transformer Support:
 - 1. Provide required support and attachment in accordance with Section 26 05 29, where not furnished by transformer manufacturer.
 - 2. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
 - 3. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Section 26 05 00.
 - 4. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
- J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.
- K. Where furnished as a separate accessory, install transformer weathershield per manufacturer's instructions.
- L. Identify transformers in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.

3.04 ADJUSTING

- A. Measure primary and secondary voltages and make appropriate tap adjustments.
- B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from transformer components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Lighting and appliance panelboards.
- B. Overcurrent protective devices for panelboards.

1.02 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2009.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- E. NEMA PB 1 - Panelboards; 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.
- G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 67 - Panelboards; Current Edition, Including All Revisions.
- K. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
 - 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- C. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Panelboard Keys: Two of each different key.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.electrification.us.abb.com/#sle.
- B. General Electric Company: www.geindustrial.com.
- C. Eaton Corporation: www.eaton.com/#sle.
- D. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- E. Siemens Industry, Inc: www.usa.siemens.com/#sle.
- F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- C. Short Circuit Current Rating:
 - 1. Provide panelboards with listed short circuit current rating Not less than 10,000 AIC.
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide fully rated neutral bus, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - b. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.

- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list and label panelboards as a complete assembly including surge protective device.
- K. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 - 1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
- L. Load centers are not acceptable.

2.03 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material: Copper.
 - 3. Ground Bus Material: Copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type.
- E. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 - 2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
 - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 3. Conductor Terminations:
 - a. Provide mechanical lugs.
 - b. Lug Material: Copper, suitable for terminating copper conductors only.
 - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - 5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
 - 6. Provide the following circuit breaker types where indicated:
 - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
 - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.

7. Do not use tandem circuit breakers.
8. Do not use handle ties in lieu of multi-pole circuit breakers.
9. Provide multi-pole circuit breakers or circuit breaker handle-ties for multi-wire branch circuits as required by NFPA 70.
10. Provide the following features and accessories where indicated or where required to complete installation:
 - a. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.05 SOURCE QUALITY CONTROL

- A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that mounting surfaces are ready to receive panelboards.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Install panelboards plumb.
- G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Install all field-installed branch devices, components, and accessories.
- J. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- K. Set field-adjustable circuit breaker tripping function settings as directed.
- L. Provide filler plates to cover unused spaces in panelboards.
- M. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
 1. Emergency and night lighting circuits.
 2. Fire detection and alarm circuits.
- N. Identify panelboards in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Test GFCI circuit breakers to verify proper operation.
- D. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.

- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 10 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Wall plates.

1.02 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- C. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- D. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).
- E. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- H. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- I. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other Divisions.
 - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
 - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
 - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 - 5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
 - 1. Do not install wiring devices until final surface finishes and painting are complete.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations. Clearly mark shop drawings to indicate which items and any options that are being provided.
- B. Project Record Documents: Record actual installed locations of wiring devices.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NEC.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hubbell Incorporated: www.hubbell-wiring.com.
- B. Leviton Manufacturing Company, Inc: www.leviton.com.
- C. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
- D. Cooper Wiring Devices: www.cooperindustries.com.
- E. Source Limitations: Where possible, provide products for each type of wiring device produced by a single manufacturer and obtained from a single supplier.

2.02 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFI receptacles with specified in-use weatherproof covers for all receptacles installed outdoors or in damp or wet locations.
- D. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- E. Provide GFCI protection for receptacles serving electric drinking fountains.

2.03 ALL WIRING DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.
- B. Finishes:
 - 1. All Wiring Devices: Ivory with satin finish, stainless steel wall plate unless otherwise indicated.
 - 2. Wiring Devices Installed flush mounted: Ivory with satin finish stainless steel wall plate unless otherwise indicated.
 - 3. Wiring Devices Installed surface mounted: Ivory with cadmium plated steel wall plate, surface type fit without overlap and have rounded corners unless otherwise indicated.
 - 4. Wiring Devices Installed in Wet or Damp Locations: Ivory with specified weatherproof cover unless otherwise indicated.
 - 5. Confirm all colors with Architect prior to ordering.

2.04 WALL SWITCHES

- A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
 - 1. Products (Hubbell Numbers):
 - a. Single Pole: HBL-1221-I.
 - b. Double Pole: HBL-1222-I.
 - c. Three Way: HBL-1223-I.
 - d. Four Way: HBL-1224-I.

2.05 RECEPTACLES

- A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 2. 2 pole, 3 wire grounding type, straight blade
 3. NEMA configurations specified are according to NEMA WD 6.
- B. Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 - a. Products (Hubbell Numbers) :
 - 1) Duplex, 2 circuit: HBL-5362-I.
 - 2) Single: HBL-5361-I.
- C. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - a. Provide integral test and reset buttons.
 - b. 2 pole, 3 wire, grounding type
 - c. 5 milliamp sensitivity, 1/30th sec. trip time
 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
 - a. Products (Hubbell Numbers):
 - 1) HBL-GF-5352-IA.
 - 2) Provide with matching coverplate.
 3. Weather Resistant GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations. Provide with gasketed, aluminum, weatherproof plate, with hinged and gasketed lid for in-use protection.
 - a. Products (Hubbell Numbers):
 - 1) Receptacle: HBL-GF-5362-IA.
 - 2) Cover Plate: WP26M, with matching box.

2.06 WALL PLATES

- A. Manufacturers:
1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
 2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
 3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
 4. Cooper Wiring Devices.
- B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 2. Size: Standard; unless noted otherwise.
 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- D. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NEC.
- B. Verify that wall openings are neatly cut and will be completely covered by wall plates.

- C. Verify that final surface finishes are complete, including painting.
- D. Verify that floor boxes are adjusted properly.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Refer to the Drawings for specific notes specifying special devices not listed above. Coordinate with the Architectural drawings for exact mounting heights and locations.
- B. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- C. Install devices securely, in a neat and workmanlike manner.
- D. Install devices generally where indicated by symbol on Drawings, but in coordination with all other trades.
- E. Coordinate the location of all devices with General Contractor and Plumbing, Fire Protection and HVAC Contractors prior to rough-in.
- F. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
 - 1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - 2. Where multiple receptacles are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
- G. Install wiring devices in accordance with manufacturer's instructions.
- H. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- I. All receptacles shall be back wired. Wiring devices shall not be used as through wiring connection points.
- J. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- K. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- L. Connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- M. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- N. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- O. Devices shall be installed so they are seated tight against the box or ring face. "Floating" devices that depend on the coverplate to tighten mounting are not acceptable.
- P. Install wall switches with OFF position down.
- Q. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on left.
- R. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or

improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

- S. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch with circuit energized to verify proper operation.
- D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 28 13 - FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fuses.

1.02 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.
- D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.
- E. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.
- F. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
 - 2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves. Clearly mark shop drawings to indicate which items and any options that are being provided.
 - 1. Spare Fuse Cabinet: Include dimensions.
- B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Fuses: One set(s) of three for each type and size installed. This includes control circuit fuses, and fuses for any installed equipment, including auxiliary systems.
 - 2. Fuse Pullers: One set(s) compatible with each type and size installed.
 - 3. Spare Fuse Cabinet Keys: Two.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NEC.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com.
- B. Littelfuse, Inc: www.littelfuse.com.
- C. Mersen: ep-us.mersen.com.

2.02 APPLICATIONS

- A. Feeders:

1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
- B. General Purpose Branch Circuits: Class RK1, time-delay.
- C. Individual Motor Branch Circuits: Class RK1, time-delay.

2.03 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12 and CSA Certified.
 1. Class RK1, Current Limiting, Low-Peak, Dual Element, Time-Delay Fuses:
 2. Dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284 degree Fahrenheit melting point alloy and shall be independent of the short-circuit clearing chamber.
 3. The fuse shall hold 500% of rated current for a minimum of 10 seconds for over 30A size, 8 seconds for 0-30A size.
 4. High in-rush current, time-delay permits 130% FLA
 5. Interrupting rating of 300,000 amperes RMS symmetrical
 6. Electrically isolated end caps
 7. Indicating Type
 - a. Products (Cooper Bussman Numbers):
 - 1) 250V - LPN-RK-SP1 Series.
 - 2) 600V - LPS-RK-SPI Series.
- H. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- I. Provide the following accessories where indicated or where required to complete installation:
 1. Fuseholders: Compatible with indicated fuses.
 2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that mounting surfaces are ready to receive spare fuse cabinet.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.
- C. Install fuses in fuse clips where required. Fuses shall not be installed in any equipment until it is ready to be energized.

- D. Furnish a typewritten list of all spare fuses stating quantity, ampere rating, voltage and use location. Mount the list in the spare fuse cabinet, include copy in O & M manual.

END OF SECTION

SECTION 26 28 16.16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed safety switches.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NEC.
 - 2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- C. Project Record Documents: Record actual locations of enclosed switches.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NEC.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.electrification.us.abb.com/#sle.
- B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
- C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- D. Siemens Industry, Inc: www.usa.siemens.com/#sle.

- E. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Enclosed load interrupter, Quick-make, quick-break, enclosed safety switches complying with NEMA KS 1, type HD (heavy duty), and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
 - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating Not less than 100,000 AIC.
- G. Provide with switch blade contact position that is visible when the cover is open.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - 2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
- L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- M. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
- N. Switch handle positions shall be marked "ON-OFF".
- O. Heavy Duty Switches:
 - 1. Comply with NEMA KS 1.
 - 2. Conductor Terminations:
 - a. Provide mechanical lugs.
 - b. Lug Material: Copper, suitable for terminating copper conductors only.
 - 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
 - 4. Switch handle positions shall be marked "ON-OFF".

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that mounting surfaces are ready to receive enclosed safety switches.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NEC.
- D. Coordinate exact switch location with equipment, ductwork, piping, etc. to ensure Code required clearances and accessibility. Where switches cannot be mounted to a wall, building structure, or equipment, furnish and install a rigid angle iron or unistrut stand for mounting switch.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Install enclosed switches plumb.
- G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Provide identification on inside door of each fused switch indicating NEMA fuse class and size installed.
- J. Identify enclosed switches in accordance with Section 26 05 53.

3.03 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.04 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 43 00 - SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surge protective devices for branch panelboard locations.

1.02 ABBREVIATIONS AND ACRONYMS

- A. SPD: Surge Protective Device.

1.03 REFERENCE STANDARDS

- A. MIL-STD-220 - Method of Insertion Loss Measurement; 2009c (Validated 2019).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.
- G. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.
- H. IEEE C62.41.1
- I. IEEE C62.41.2
- J. IEEE C62.43-2005
- K. IEEE C62.45-2002
- L. IEEE C62.48-2005
- M. IEEE C62.62-2010
- N. UL 96A
- O. NFPA 780

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.05 SUBMITTALS

- A. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
 - 1. SPDs with EMI/RFI filter: Include noise attenuation performance.
- B. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.
- C. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
 - 1. UL 1449 current edition listed, 20 kA In Type 1 or Type 2 for use in UL 96A systems.
 - 2. UL 1283 (for Type 2 SPDs).
- D. Field Quality Control Test Reports.

- E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.
- G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- H. Project Record Documents: Record actual connections and locations of surge protective devices.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.
- B. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Factory-installed, Internally Mounted Surge Protective Devices:
 - 1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.
- B. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

- A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.
- B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mounted SPDs.
- C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.
- D. Protected Modes:
 - 1. Wye Systems: L-N, L-G, N-G, L-L.
- E. Nominal Discharge Current (In) – All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.
- F. UL 1449 Voltage Protection Ratings (VPRs):

1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
- G. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards. End of life mode to be open circuit. Unit with end of life short-circuit mode are not acceptable.
- H. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.
- I. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 1. Indoor clean, dry locations: Type 1.
- J. Unit shall operate without the need for an external overcurrent protection device (OCPD), and be listed by UL as such. Unit must not require external OCPD or replaceable internal OCPD for the UL Listing.
- K. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
 1. Panelboards: See Section 26 24 16.

2.03 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

- A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.
- B. List and label as complying with UL 1449, Type 1 or Type 2.
- C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.
- D. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.
- E. UL 1449 Nominal Discharge Current (I-n): 20 kA.
- F. UL 1449 Short Circuit Current Rating (SCCR): Not less than the short circuit current rating of the equipment the SPD is connected to, including any series ratings.
- G. Diagnostics:
 1. Protection Status Monitoring: Provide indicator lights to report the protection status.
 2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
 3. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.
- H. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
- B. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.
- C. Verify system grounding and bonding is in accordance with Section 26 05 26, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. The installation of the SPD shall be factory installed integral to the distribution equipment. The Contractor shall install all distribution equipment per the manufacturer's recommendations, applicable electrical codes and the contract drawings.
- E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.
- F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.
- G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 05 26 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.
- H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS Section 7.19.1.
- C. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.04 CLEANING

- A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 51 01 - LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior and exterior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Luminaire accessories.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other Divisions. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
 - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other Divisions.
 - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other Divisions.
 - 4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.03 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
 - 1. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
 - 2. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
 - b. Include IES LM-79 test report upon request.
- B. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NEC.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 502 (industrial lighting) and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.06 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.07 WARRANTY

- A. Provide five year pro-rata warranty for batteries for emergency lighting units.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. The first listed lighting fixtures scheduled on the drawings are specified as the "basis" for quality and to compliment the architectural design of the building. Fixtures of other manufacturers noted on the drawings may be used provided they are equal to or better than the basis fixtures.
- C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NEC.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
- H. LED Luminaires: Listed and labeled as complying with UL 8750.
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED estimated useful life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 EMERGENCY LIGHTING UNITS

- A. Description: Emergency lighting units complying with NFPA 101 and all applicable local codes, and listed and labeled as complying with UL 924.
- B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- C. Battery:
 - 1. Sealed maintenance-free lead calcium unless otherwise indicated.
 - 2. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- E. Provide low-voltage disconnect to prevent battery damage from deep discharge.
- F. Accessories:
 - 1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
 - 2. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.04 EXIT SIGNS

- A. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable local codes, and listed and labeled as complying with UL 924.
 - 1. Number of Faces: Single or double as indicated or as required for the installed location.
 - 2. Directional Arrows: As indicated or as required for the installed location.
- B. Self-Powered Exit Signs:
 - 1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
 - 2. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
 - 3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
 - 4. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.05 BALLASTS

- A. Drivers:
 - 1. Electronic Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

2.06 LAMPS

- A. LED Modules
 - 1. Fixture lumen output is noted on fixture schedule. The lumen output is for the fixture not just the LED module.
 - 2. Interior fixtures to have 3500 deg. K color temperature, Exterior fixtures to have 4000 deg. K color temperature or as noted on the drawings.
 - 3. All LED fixtures to be tested in accordance with IESNA LM-79 and LM-80
 - 4. Off state power draw of LED fixtures to be no more than 0.5 watts
 - 5. Minimum power factor to be 0.9

2.07 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NEC.
- B. Verify that suitable support frames are installed where required.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.

- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA 500 (commercial lighting).
- D. Fixtures shall not be installed until painting work of the General Contractor is completed.
- E. Furnish all required installation accessories for the fixtures as required for the specific location whether or not included in the manufacturer's catalog number on the Drawings. Such accessories may include, but not be limited to, mounting straps, plaster frames, rings and frames, canopies, stem hangers, continuous row mounting and suspension methods. Refer to Architectural Room Treatment Schedule.
- F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- G. Locate recessed ceiling fixtures as indicated on reflected ceiling plan.
- H. Suspended Ceiling Mounted Luminaires:
 - 1. Do not use ceiling tiles to bear weight of luminaires.
 - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
 - 3. Secure surface-mounted and pendant-mounted luminaires to building structure.
 - 4. Secure pendant-mounted luminaires to building structure.
 - 5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
 - 6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
- I. Recessed Luminaires:
 - 1. Install trims tight to mounting surface with no visible light leakage.
 - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
- J. Suspended Luminaires:
 - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
 - 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
 - 3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
 - 4. Install canopies tight to mounting surface.
 - 5. Unless otherwise indicated, support pendants from swivel hangers.
 - 6. Stem mounted fixtures in unfinished areas are to be supported with rigid conduit stems hung from ball joint coverplates. Ball joint coverplates to be steel with cast iron ball. Mounting height of stem-suspended fixtures to be adjusted to suit conditions of exposed beams, piping and air ducts in coordination with other trades.
 - 7. Install suspended exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
 - 8. Mounting height of stem-suspended fixtures to be adjusted to suit conditions of exposed beams, piping and air ducts. Provide strut type mountings below ductwork or piping where required.
- K. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
- L. Surface Mounted Luminaires:
 - 1. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- M. Install accessories furnished with each luminaire.
- N. Bond products and metal accessories to branch circuit equipment grounding conductor.
- O. Emergency Lighting Units:

1. Unless otherwise indicated, connect unit to unswitched power from circuit indicated. Bypass local switches, contactors, or other lighting controls.
 2. Install lock-on device on branch circuit breaker serving units.
- P. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from circuit indicated. Bypass local switches, contactors, or other lighting controls.
- Q. Install lamps in each luminaire.
- R. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
- S. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within fixture; use flexible conduit (maximum 6' length).

3.04 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Fixtures with broken or scratched glass or damaged parts or finishes to be replaced.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.
- E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.
- C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

- A. Clean surfaces according to NECA 502 (industrial lighting) and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires.
- B. Drivers.
- C. LED Modules.
- D. Luminaire accessories.

1.02 REFERENCE STANDARDS

- A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.
- B. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 2013-08, with 2015 Corrigendum.
- C. IEEE C2 - National Electrical Safety Code; 2012.
- D. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).
- E. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- F. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.
- G. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- I. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2006.
- J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- M. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate placement of poles and associated foundations with existing utilities, curbs, sidewalks, trees, walls, fences, striping, etc. Coordinate elevation to obtain specified foundation height.
 - 2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
 - 2. Provide photometric calculations where luminaires are proposed for substitution upon request.
 - 3. Provide structural calculations for each pole upon request.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting

requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
 - b. Include IES LM-79 test report upon request.
2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
3. Lamps: Include rated life and initial and mean lumen output.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.
 2. Touch-Up Paint: 2 gallons, to match color of pole finish.
- F. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.07 WARRANTY

- A. Provide five year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
- H. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.
- I. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.
- J. LED Luminaires:
 1. Components: UL 8750 recognized or listed as applicable.
 2. Tested in accordance with IES LM-79 and IES LM-80.
 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- K. LED Luminaire Components: UL 8750 recognized or listed as applicable.
- L. Exposed Hardware: Stainless steel.

2.02 DRIVERS

- A. Drivers - General Requirements:
 1. Provide drivers containing no polychlorinated biphenyls (PCBs).
 2. Minimum Efficiency/Efficacy: Provide drivers complying with all current applicable federal and state ballast efficiency/efficacy standards.
 3. Electronic Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.
- B. Dimmable LED Drivers:
 1. Dimming Range: Continuous dimming from 100 percent to ten percent relative light output unless dimming capability to lower level is indicated, without flicker.
 2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.03 LED MODULES

- A. General Requirements:
 1. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
 2. Color Temperature Consistency: Unless otherwise indicated, for each type of module furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.
- B. LED Modules
 1. Fixture lumen output is noted on fixture schedule. The lumen output is for the fixture not just the LED module.
 2. Exterior fixtures to have 4000 deg. K color temperature or as noted on the drawings.
 3. All LED fixtures to be tested in accordance with IESNA LM-79 and LM-80
 4. Off state power draw of LED fixtures to be no more than 0.5 watts
 5. Minimum power factor to be 0.9

2.04 ACCESSORIES

- A. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.

- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires in accordance with NECA/IESNA 501.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- G. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- H. Install accessories furnished with each luminaire.
- I. Bond products and metal accessories to branch circuit equipment grounding conductor.
- J. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

3.06 CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 27 05 00 - COMMUNICATIONS GENERAL PROVISIONS

PART 1 GENERAL

1.01 EXTENT OF WORK

- A. Furnish all materials, labor, tools, equipment, service and incidentals to complete and leave ready for operation all technology systems of this project as called for in these Specifications, shown on accompanying Drawings and required by governing codes.

1.02 GENERAL REQUIREMENTS

- A. Carefully read all Specifications and examine drawings covering all branches of work to be fully informed regarding work to be done as part of this Contract.
- B. Visit Site during Bidding Period to review the documents and become acquainted with all features of work to be performed. Failure to inspect the Site prior to bidding will not relieve Contractor of performance of any item of work required by existing conditions.
- C. Drawings accompanying these Specifications are complementary to them; whatever is called for by one shall apply to both unless specifically stated and shown otherwise. Any discrepancies to be clarified with the Architect during the Bidding Period. See "Instructions to Bidders."
- D. Material and equipment installed under this Contract to be new, un-deteriorated and of quality not less than the minimum specified herein. Materials for which Underwriters' Examination Service is provided shall bear the U.L. label.
- E. Workmanship and installation procedures to be in accordance with best practices of the trade.
- F. All work shall be performed by competent workman and executed to meet or exceed standards of installation and good workmanship for the trade.
- G. Cable, wire, and outlet installation shall be performed by personnel that have been certified by an organization such as BICSI (Building Industry Consulting Service International) or have at least 5 years experience in the telecommunication industry.
- H. Electrical work to be installed by journeymen electricians under direct supervision of qualified and competent foremen. At no time is Electrical work to be installed by apprentice electricians or laborers without the immediate on-the-job supervision of a journeyman electrician. Work to meet or exceed standards of installation and good workmanship set forth in the "NECA Standard of Installation" except as modified in these Specifications or shown on the Drawings.
- I. Furnish and install all necessary hangers, supports, straps, pull boxes, junction boxes and fittings not indicated on the Drawings, but which are required for a complete and properly installed system, consistent with the architectural treatment of the Building.
- J. Design shown on the Drawings is based on particular types or makes of equipment. If other types or makes of equipment are furnished, which require modifications or changes in the Drawings or Specifications, this Contractor shall be responsible for such changes, the cost of which shall be included in the Bid. In such case, prior to starting work, submit to Architect for approval, Drawings and Specifications showing such modifications and changes, and do not proceed with work until approval has been obtained. See "Instructions to Bidders."
- K. Consult all Contract Drawings which may affect the location of equipment, conduit, or cabling and make minor adjustment in location to assure coordination. Other than minor adjustment to be submitted to the Architect for approval before proceeding with work.
- L. Architect reserves the right to direct the removal and replacement of any item of work which, in his opinion does not present an orderly, reasonably neat and workmanlike appearance, provided such items can be properly installed in such orderly way by methods usual in such work. Such removals or replacements to be done by this Contractor when so directed by the Architect and all cost in connection therewith to be paid by this Contractor.
- M. Work found unacceptable by testing procedures, inspection agencies or Architect to be immediately corrected at no additional cost to the Owner. Work to be considered unacceptable when it is contrary to the Specifications, governing codes or accepted standards of good workmanship.

- N. Insofar as this branch of work is concerned, keep premises in neat and orderly condition and promptly clean up and cart away debris and excess material.
- O. The intent is that the Work of this Contract be complete in every respect and any equipment, materials, labor or details not specifically called for herein or shown on the Drawings, but necessary to fully complete the work, to be furnished and installed complete.
- P. Materials and associated installation procedures required, but which are not specifically listed under specific articles of these Specifications are to conform to the appropriate article of these Specifications.
- Q. Where particular types or makes of equipment are specified to match existing, no deviations or substitutions will be allowed. However, where equipment to match existing is no longer available, a substitution will be allowed which matches existing equipment as close as possible.
- R. Before completed work is released for beneficial occupancy, carefully make adjustments necessary for proper functioning of systems and equipment required under this Division and instruct representative(s) of the Owner in care and operation thereof.

1.03 SCHEDULING AND ORDER OF WORK

- A. Upon approval of Contract, prepare a schedule, prior to starting operations, of all stages of work and sequence to be performed.
- B. Scheduling of work to be coordinated with delivery schedules and work schedules prepared by other trades directly involved.

1.04 CODES

- A. Perform all work in accordance with the 2023 edition of the National Electrical Code as issued by the National Fire Protection Association, the Ohio Building Code, and any prevailing codes of the county, political sub-division or local governmental agency having jurisdiction.
- B. The above codes are minimum requirements. Where the Drawings and Specifications call for higher requirements, the Drawings and Specifications shall govern.

1.05 PERMITS, INSPECTIONS AND FEES

- A. Refer to General Conditions for building and trade permits and licenses.
- B. Permits: Architect shall obtain all permits of state, county, city, political sub-division or local governmental agency having jurisdiction required by law or ordinance. Architect shall file any Drawings necessary to obtain said permits.
- C. The Contractor shall submit any shop drawings that are required to complete the permits to the Architect in PDF format.
- D. Inspections
 - 1. Electrical inspections (including any required low-voltage) to be performed by the inspection agency having jurisdiction for the area.
 - 2. Notify inspection agency for inspections of work before work is concealed.
 - 3. Work found unacceptable by the Architect and inspection agencies to be immediately corrected at no additional cost to the Owner. Work to be considered unacceptable when it is contrary to Drawings, Specifications, governing codes and accepted standards of good workmanship.

1.06 EMERGENCY SERVICE

- A. Emergency service shall be provided for installation or equipment failures in any part of the Technology work, on verbal demand, prior to final acceptance and during the Guarantee period.
- B. The Owner will designate three (3) individuals who will initiate the call for emergency service. The Contractor shall, in turn, designate three (3) individuals, together with current telephone numbers, who will and can perform the emergency service.
- C. Emergency services performed which are not due to defects of work or materials supplied by this Contractor will be paid by the Owner.

1.07 SHOP DRAWINGS AND SUBMITTALS

- A. Refer to the "General Conditions" and Division 1.
- B. Shop drawings and submittals shall be provided for any and all items required by the Contract Documents, including but not limited to: all components of data, phone, video, clock, security and all sound systems, wiring systems, wiring devices and cover plates, and all other specified auxiliary systems being supplied.
- C. Shop drawings for distribution (head-end) equipment to include front view, side view, plan view, dimensions, accessories, nameplate schedule, etc.
- D. Catalog cuts and specification sheets may be used for items such as wiring devices, cover plates, wire, etc., if products are adequately described and if all requirements and options of the exact item being furnished are clearly marked.
- E. Contractor to review, approve and stamp shop drawings and submittals to ensure contract requirements are met before forwarding. By reviewing and stamping shop drawings and submittals, the Contractor indicates that he has determined and verified materials, field measurements and related field construction criteria, or will do so, and has coordinated all information with the requirements of the work, contract documents, existing conditions and all other trades. Submittals to be itemized on a transmittal sheet.
- F. The Architect's review of shop drawings and submittals shall not relieve the Contractor from responsibility of errors or omissions in manufacturer's drawings and deviations from the Architect's Drawings or Specifications.
- G. The above required shop drawing and review submittals are for review for installation in accordance with the Contract Drawings and Specifications and in no way void the requirements of the "General Conditions" for material and equipment list submittals subsequent to the signing of the Contract.
- H. All shop drawings and review submittals to be securely fastened in a folder (or binder). Each folder to contain one (1) copy of each item or type of equipment, thus forming one (1) submittal set. Each set to be complete with a title sheet, stating the project name and location, Architect, Engineer, Contractor and a table of contents. Allow sufficient space for review stamps.
- I. Shop drawings and review submittals not received as described above shall be returned without consideration of reviewing. See division one for further submittal information.

1.08 JOB CLOSING SUBMITTALS

- A. Following submittals to be forwarded to Architect prior to application for final job inspection.
 - 1. Electrical (low voltage) Certificate of Inspection and Approval.
 - 2. Certificates from designated personnel that they have received instructions and understand operations of systems.
 - 3. Field notes, sketches, wiring connection diagrams and wiring drawing. Material to be properly cross-referenced with Contract Documents.
 - 4. Checkout, performance and test reports made by respective field representative on security systems installed.
- B. Refer to Division I - General Requirements for additional closeout submittals.

1.09 LAYOUTS, BUILT-IN WORK AND COORDINATION

- A. LAYOUTS
 - 1. Layout shown on the Drawings is schematic, exact locations to be determined by structural and other conditions. This does not mean that the design of the system may be changed; it refers only to the exact locations of devices and equipment to fit into the Building was constructed and the coordination of conduit and other equipment with piping, ductwork and equipment included under other divisions of the Specifications.
 - 2. Where the locations of any items are indicated by dimension on the Drawings, such items must be accurately located exactly as indicated.

3. Special care to be exercised in locating outlets, speakers and all other devices symmetrically in ceiling panels and other architectural features of the Building.
4. If so instructed by the Architect or Owner, the location of any outlet or outlets to be moved a distance not to exceed 5'-0" in any direction without additional cost, provided such instructions are given prior to the installation of such outlet or outlets.
5. The exact location of floor outlets shall not be scaled from the Drawings, but verified in the field from the final equipment drawings or as determined by the Architect's representative in consideration of equipment layouts.

B. BUILT-IN WORK AND COORDINATION

1. Before installing work, this Contractor shall see that it does not interfere with clearances required by Code for finish on beams, columns, pilasters, walls or other structural or architectural members shown on the Architectural or Structural Drawings.
2. If work is installed in a manner that it later develops that the architectural design cannot be followed, Contractor to make changes as required by the Architect to permit the completion of the architectural work in accordance with the Drawings and Specifications.
3. Examine the Electrical, Plumbing, Fire Protection, and HVAC Drawings to ensure that technology work does not interfere with or will not be covered by plumbing equipment, heating units, pumps, motors, fans, radiation, etc.
4. Where technology equipment is to be installed in areas with electrical equipment, ductwork, piping and plumbing, the superintendents and foremen of the trades involved to coordinate locations of all items prior to installation. Should this coordination be ignored, or relocation of items be necessary to provide code clearances, such relocation to be done at no change in price.
5. When installing equipment and pathways allow maximum possible headroom, unless specific mounting heights are noted that conflict with maximum headroom or if reduced mounting height is required due to coordination with other trades.
6. It is the Contractor's responsibility to see that all equipment and apparatus that may require maintenance is made easily accessible. Although the location of the equipment may be shown on the Drawings, the construction of the structure and the location of other equipment may disclose that location of equipment does not make its position readily accessible. Contractor to call the attention of the Architect to the condition before advancing the construction to a point where a change in the location would reflect additional cost.
7. Particular attention should be given to the above mentioned Drawings for changes made on those Drawings which are not reflected on the Technology Drawings. Any changes necessary to work installed under this Contract which could have been avoided by the foregoing references, to be made and paid for by this Contractor.
8. This contractor to keep himself fully informed of progress of the construction and install all work that is concealed and built into the Building in sufficient time to ensure proper location without delays to work of other trades.

1.10 CLEANING AND PAINTING

- A. Interiors of all conduits to be swabbed clean and dry before pulling wire.
- B. Interiors of enclosures to be cleaned of dirt and debris before installing trim or covers.
- C. Finished surfaces of equipment furnished and installed to be thoroughly cleaned of dirt. Scratches or damaged surfaces to be properly repaired and painted to match existing.
- D. Areas worked in to be cleaned of debris resulting from installation.
- E. No finished painting except as noted below is required.
- F. Finished surfaces of equipment furnished and/or installed which are scratched or skinned to be properly prepared for painting and touched up with type of paint used on original finish.
- G. Rust spots to be brushed clean, primed and painted with type of paint used on original finish.

- H. Wood mounting panels to have edges sanded to remove wood splinters and be non-combustible treated. Prime and paint with gray flameproof paint on both sides and edges before mounting.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING

- A. Provide grounding as required by NEC and all local codes for a complete system.
- B. Refer to section 26 05 26 for grounding and bonding requirements.

2.02 HANGER AND SUPPORTS

- A. Furnish and install all necessary hangers, supports, straps, pull boxes, junction boxes and fittings not indicated on the Drawings, but which are required for a complete and properly installed system, consistent with the architectural treatment of the Building. Refer to Division 26 Specification sections for all boxes, conduit, supports and firestopping requirements.
- B. J-HOOKS
 - 1. J-hooks may be used for routing cables in areas of the building where cable tray and conduits are not required to be provided. And where cable support is required between conduit stub-outs and cable tray.
 - 2. Double-sided J-Hooks may be utilized
 - 3. Provide all support hardware per manufacture recommendations for a complete installation.
 - 4. J-Hooks shall be Cooper B-Line or equals by ICC, MPHusky, Panduit, Caddy or Chalfant Co

PART 3 EXECUTION

3.01 INSTALLATION

- A. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code, 2023 and all appropriate local codes.
- B. Coordinate all rough-in and pathway installation and requirements with all other trades. Refer to division 26 for all conduit, box, support and firestopping requirements.
- C. Installation should be performed in a professional manner using the best practices in the industry.
- D. Fill ratios for conduit, raceways and j-hooks shall conform to industry standards and manufacturer's recommendations. All cabling in room walls shall be installed in conduit and/or surface mounted raceway.
- E. Any cable pathway, shall be at 40% fill rate or less at project completion, if cable pathway is greater than 40% additional pathway the Contractor shall notify the A/E to determine additional pathways.
- F. Conduits to the technology outlets are to be a minimum of one inch. A dedicated conduit will serve each outlet box. Conduit "stub ups" will extend 2' from the wall, angle to the center of the room which it feeds, and must have conduit bushings on the ends.
- G. Where J-hooks are allowed, above suspended ceilings in rooms, the Contractor shall bundle, in bundles of 10 or less, cables with plenum rated Velcro ties, snug, but not deforming the cable geometry. Cable bundling shall be supported via "J" hooks attached to the building structure and framework at a maximum of via (5) foot intervals. The intervals shall be staggered, so each spacing is not exactly 5'; 4'-6", then 4'-9", then 5', then 4'-9" and so on. J-Hooks and cabling routing paths are to be coordinated with all other trades.
- H. J-hooks will be placed only above drop tile ceiling with a minimum clearance of 6" between T-bar and j-hook; at no time will the cable clearance be less than 3" to the T-bar. At no point, will the cable contact the ceiling or any other trades work. J-hooks shall not be placed more than 18" above drop ceiling

- I. J-hooks shall not be routed along walls, pathway will run to center of room and out to hallway if drywall is extended to ceiling a sleeved hole will be placed.
- J. J-hooks shall be provided within one foot of all conduit stub-outs and within one foot of any bend greater than 60 degrees.
- K. Conduit will be used in inaccessible environments such as: drywall ceilings/walls or any location where pathway is not readily accessible. This includes but not limited to: above HVAC ductwork, lab counters, cabinets and height issues not being able to safely access pathway from a step ladder.
- L. J-Hooks and/or cable tray will not be placed above hard ceiling or areas where there is no access or limited access (due to HVAC ducts or piping).
- M. Provide pull boxes as required for easy of cable installation and per industry standards for a complete installation. All boxes shall be accessible. See division 26 specification sections for box requirements.
- N. All cable pathways shall be placed parallel and perpendicular to building lines.
- O. The Contractor shall provide 4-inch conduit sleeves (or sizes noted on drawings) for penetrations in fire rated walls between areas for cable passage. Sealing of openings for cable pass through through rated fire and smoke walls, shall be the responsibility of the Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over his work. The firestopping provided for communication cabling shall be of a mechanical type to allow re-entry; see specification section 26 05 55. Creation of such openings as are necessary for cable passage between locations shall be the responsibility of the contractor's work. Any openings created by or for the contractor and left unused shall also be sealed as part of this work.
- P. The Contractor shall be responsible for damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.
- Q. Communication outlet mounting height shall be at same height as electric outlets unless noted otherwise.

END OF SECTION

SECTION 27 14 00 - COMMUNICATIONS CABLING

PART 1 GENERAL

1.01 SCOPE

- A. Furnish and install all items of equipment, pathways, wiring, outlets, and accessories required for a complete communication wiring system as described herein and shown on the drawings.
- B. Provide all connectivity, outlets, etc.

1.02 REFERENCE STANDARDS

- A. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; Electronic Industries Alliance/Electrical Components Association; Revision E, 2005.
- B. ICEA S-83-596 - Indoor Optical Fiber Cables; Insulated Cable Engineers Association; 2011.
- C. ICEA S-90-661 - Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cables (With or Without An Overall Shield) For Use in General Purpose and LAN Communications Wiring Systems Technical Requirements; 2012.
- D. NECA/BICSI 568 - Standard for Installing Building Telecommunications Cabling; National Electrical Contractors Association; 2006.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. The National Electrical Code 2017, Article 800
- G. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; 2012.
- H. TIA-492AAAB - Detail Specification for 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009a.
- I. TIA-492AAAC - Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009b.
- J. TIA-492AAD - Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; Telecommunications Industry Association; 2009.
- K. TIA-492CAAA - Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers; 1998 (R 2002).
- L. TIA-492CAAB - Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers with Low Water Peak; Telecommunications Industry Association; 2000 (R2005).
- M. TIA-526-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant; Rev A, 2015.
- N. TIA-526-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; Rev C, 2015.
- O. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2015.
- P. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2009c, with Addendum (2016).
- Q. TIA-568.3 - Optical Fiber Cabling and Components Standard; 2016d.
- R. TIA-569 - Telecommunications Pathways and Spaces; 2015d, with Addendum (2016).
- S. TIA-598 - Optical Fiber Cable Color Coding; 2014d.
- T. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2017c.
- U. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2015c, with Addendum (2017).
- V. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- W. UL 444 - Communications Cables; Current Edition, Including All Revisions.

- X. IEEE 802.3 Ethernet 10Base-T LAN
- Y. IEEE 802.5 Token Ring LAN
- Z. ANSI X3T9.5 FDDI
- AA. TSB 67: Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems.
- AB. TSB 75: Additional Horizontal Cabling Practices for Open Offices
- AC. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.
- AD. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.03 GENERAL REQUIREMENTS

- A. All cable installed shall meet the requirements of Article 800 of the National Electrical Code.
- B. Cable, wire, and outlet installation shall be performed by personnel that have been certified by an organization such as BICSI (Building Industry Consulting Service International) or have at least 5 years experience in the telecommunication industry.
- C. All cable that is to be connected to or disconnected from the communication network must be reported to the Owner for approval. This must be submitted in writing so that accurate records and databases can be maintained.
- D. Communication cabling and outlet equipment is based on products by Hubbell or Owner approved equal and constitutes the type and quality of equipment to be furnished. The system shall be complete in every respect including all necessary equipment shown or not shown on the drawings to perform the functions relative to the system operation.
- E. Supply and install a complete telecommunications cabling system that is based on a physical star wiring topology and designed in accordance with, and supported by, a manufacturer's backed warranty certification as specified herein.

1.04 CABLING SYSTEM DISTANCES MUST CONFORM TO THE LIMITATIONS LISTED BELOW:

- A. Telecommunications Cabling System Backbone Channel Distance Limitations
 - 1. UTP Copper (LAN Cables)
 - a. A - *295ft (90M)
 - b. B - *295ft (90M)
 - c. C - *295ft (90M)
 - d. D - *295ft (90M)

1.05 QUALITY ASSURANCE

- A. Qualification of Contractor:
 - 1. The Contractor shall provide a technical resume of experience for the project manager assigned to this project. This person shall be a BICSI - Certified RCDD (Registered Communications Distribution Designer) listed on the BICSI website with current credentialing. Contractor submittals shall include copies of all certificates of staff to work on the project.
 - 2. The cabling contractor must have a minimum of five (5) years of documented experience installing structured cabling systems.
 - 3. The Contractor (including subcontractor(s) if any) shall have experience in installing cabling systems as evidenced with a listing of at least 3 projects involving Category 6 cabling that have been completed by the Contractor in the last 2 years. Names, addresses and phone numbers of referenced projects shall be included.
 - 4. The cable manufacturer along with the contractor is responsible for the final warranty and certification of the application assurance.
 - 5. The Contractor shall show proof of a contractual relationship through a certification process with the manufacturer of the proposed connectivity solution, and shall be authorized to pass through the manufacturer's warranty to the purchaser.

6. The Contractor must hold a current certification from the manufacturer of the proposed connectivity solution. This certification must be valid for both installation and testing and shall enable the Contractor to offer the full manufacturer's product and applications warranties as specified. All technicians working on the project will have manufacturers training and training certificates.
 7. Manufacturers used for this project shall have a certification program and the successful contractor or his sub-contractors shall be certified by the manufacturer for installation of their system components.
 8. All cabling, termination hardware, and connecting cords shall be sourced from the certifying manufacturer to assure quality control and validity of the manufacturer's warranty.
 9. The Contractor will accept complete responsibility for the design, installation, certification, and support of the cabling system. Contractor must show proof that he has the certifying manufacturer's support on all of these issues.
 10. In the event that subcontractors are used for any portion of the work the Owner will hold the Contractor responsible for any required corrective action.
 11. All work shall be performed and supervised by Telecommunications Technicians and Project Managers who are qualified to install voice and data cabling systems and to perform related tests as required by the manufacturer in accordance with the manufacturer's methods and as stated in these documents.
 12. Technicians shall be fully trained and qualified by the manufacturer on the installation and testing of the equipment to be installed. Evidence that the Contractor is a current certified installer of the manufacturer must be provided in writing prior to work commencing on the structured cabling project.
 13. All installation personnel shall be BICSI certified staff and listed as such on the BICSI website. There shall be at least one BICSI certified technician during all cable installation work.
 14. A Fluke Certified Cabling Test Technician (CCTT) will perform all testing on the project. Testing may be completed by an approved equal certified technician.
- B. Qualification of System:
1. This project will have a minimum 20-year warranty offered by the connectivity solution.
 2. Acceptable proposed Systems will be covered by a two part certification program provided through the Contractor by the manufacturer. The first part must be an assurance program that guarantees that the certified system will support the applications for which it is designed, for 20 years.
 3. The certification shall be a twenty-year warranty provided by the manufacturer and the Contractor on all products within the system (cords, telecommunications outlet/connectors, cables, cross-connects, patch panels, etc.).
 4. In the event that the certified system ceases to support the certified application(s), whether at the time of cut-over, during normal use or when upgrading, the manufacturer and Contractor shall commit to promptly implement corrective action.
 5. Documentation proving the proposed components comply with TIA/EIA 569-A shall be provided by the Contractor prior to the installation of the structured cabling system.
 6. The cabling system must conform to the current industry standard ANSI/TIA/EIA-568-B.1, B.2 and B.3. All performance requirements of this document must be followed. Workmanship and installation methods used shall be equal to or better than that found in the BICSI (Building Industry Consulting Service International) TDM manual (current Edition).
 7. Manufacturer shall maintain ISO-9002 Quality Control registration for the facilities that manufacturer the product used in this cabling system.
 8. Buildings' telecommunication pathways should conform to EIA/TIA-569, and must not in any way affect the performance of the cabling system. Modification to administrative issues require written approval from the Owner and certifying manufacturer.
 9. The cabling system must conform to applicable Building and Electrical Safety Codes.

10. The Contractor shall provide the Owner with a warranty document describing the essential system elements and the Owner's responsibility for maintaining the integrity of the cabling system over time. This document shall include, at a minimum, guidelines for system expansion and modification (moves, additions, service changes) as well as cable, and hardware records and record-drawings.

1.06 SUBMITTALS

- A. Contractor shall submit:
 1. A complete telecommunications cabling system layout, including cable routing/pathways, wiring closet(s) and telecommunications outlet/connector designations. Drawings to be scaled on a minimum sheet size of 24"x36".
 2. Manufacturer's technical documentation and cutsheets on all cable and devices used in the cabling system for a complete and operable system, included but not limited to: Cable, LSupports (J-Hooks), Jacks and Faceplates, Patch Cords, Labeling .
 3. Provide Contractor's Certification training certificate from manufacturer for each technician.
 4. The Contractor shall show proof of having at least one Registered Communication Distribution Designer (RCDD) on staff to perform the review and verify the functioning of the cabling system.
 5. Provide Contractor's Fluke CCTT certificate or approved equal equivalent
 6. Factory calibration sheets for all testers being used on project
 7. Comply with Division 01 for all other submittal requirements

1.07 SYSTEM CLOSE-OUT DOCUMENTATION

- A. Contractor shall provide a document describing the end user's responsibilities for maintaining the cabling system's certification during the 20 year system warranty.
- B. O&M manuals and as-built drawings
- C. All testing records, including the Owner's approved labeling scheme
- D. Comply with Division 01 for all other submittal requirements

1.08 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 1. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
 2. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 3. Coordinate all communication outlet locations with the power receptacles prior to rough-in's.
 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meeting: Convene two weeks prior to commencing work of this section to review requirements and details with Architect and Owner representatives.

PART 2 PRODUCTS

2.01 GENERAL

- A. All components of the structured cabling system will be Component Certified to meet the appropriate category of cabling being installed. The manufacturer shall provide Category 6 component compliance certificates from a recognized third party testing organization upon request. All jacks, faceplates, patch panels, and patch cords will be of one manufacturer and supplied by the contractor. At no time are "modular plugs" for terminations acceptable.

2.02 CAT6 CABLE

- A. All Category 6 cables shall be 4-pair, twisted, 23awg, 250MHz and conform to TIA/EIA 568B Commercial building Telecommunications Cabling Standard, Horizontal Cable Section. These cables shall have the following electrical performance specifications across the frequency spectrum relative

1. Certified to 1 GB
2. DC Resistance (Max) Ohms/100M (328 FT) at 20 degree C.: 8.9
3. Return Loss dB (minimum) at 100 MHz: 20.1
4. 40.0 dB of Margin for Power Sum Near End Crosstalk at 100MHz.
5. Greater than 19.0 dB margin for Attenuation at 100 MHz.
6. 21+ dB of Margin for Attenuation to Crosstalk Ratio at 100 MHz.
7. 19.5 dB of margin for Structural Return Loss at 100 MHz.
8. Input Impedance (100 ohms): 100W $\pm$ 22% (100-350 MHz)
9. Characteristic Impedance (100 ohms): 100W $\pm$ 15%
10. Delay Skew Max. ns/100m: 25
11. Mutual Capacitance (Nominal) pF/ft. at 1kHz:14
12. Worst Pair Power Sum Crosstalk specs (dB @100M):

a. Frequency	Power Sum Next dB (Min)	Max Attenuation	dB/100M (328 FT)
b. 1.00 MHz		68	2.0
c. 4.00 MHz		59	4.1
d. 10.00 MHz		53	6.5
e. 16.00 MHz		50	8.2
f. 20.00 MHz		48	9.3
g. 31.25 MHz		45	11.7
h. 62.50 MHz		41	17.0
i. 100.00 MHz		38	22.0
j. 200.00 MHz		33	32.4
k. 300.00 MHz		31	41.0
l. 350.00 MHz		30	44.9

B. Color Codes:

1. Pair 1 - White Blue, Blue White
2. Pair 2 - White Orange, Orange White
3. Pair 3 - White Green, Green White
4. Pair 4 - White Brown, Brown White

C. The system shall meet or exceed the EIA/TIA Category 6 Standards or proposed standards at the time of the cable plant installation.

D. Cable shall be plenum rated

E. Outer jacket color be by system type:

1. Data - blue
2. CCTV Cameras - Yellow

F. Acceptable cables shall be by Panduit #PUP6004BU-UY

G. Or approved equals by Hubbell, or Owner approved

2.03 COMMUNICATIONS OUTLETS

A. Each communications outlet location shall be provided with devices as shown on drawings and specified herein. Contractor shall verify the color of all faceplates with the Architect before placing an order for these items. Modular connector colors shall be different colors for each system: Cat6 connector colors shall be:

1. Data - blue
2. Wireless Access Points - Orange
3. CCTV Cameras - Yellow

B. Communications outlets/connectors (modular jacks) shall be provided as shown on the plans and provided with connection to the horizontal media. All communications outlet/connectors shall be installed complete in an appropriate box with proper faceplate, jacks and wiring.

C. Flush communications outlets shall provide sufficient space to allow for up to a maximum of six connectors per single gang communications outlet and nine connectors per double gang

communications outlet. Surface mount communications outlets shall provide up to four communications outlet/connectors.

- D. Face plates shall be clean in appearance. Mounting hardware shall not be visible on the faceplate
- E. The available modular telecommunications outlet/connectors shall include UTP 8 position CAT6 connectors, A/V connectors, HDMI connectors, etc. as detailed on the drawings. No additional mounting hardware shall be required to mount outlet/connectors into faceplate.
- F. All communications outlet faceplates shall be made of high impact 94 V-O Rated thermoplastic
- G. CAT6 UTP Modular jacks shall have the following features:
 - 1. Bifurcated contacts for exceptional spring force and tight contact.
 - 2. Jack contacts shall be made of Beryllium copper with a minimum of 50 micro-inch gold plating.
 - 3. Jack contacts shall be bi-plane staggered to improve crosstalk stability.
 - 4. Jack must be of a universal A & B wiring.
 - 5. Jack must be a fully automated product
 - 6. Jacks to have a holder plate so proper punch down is made.
 - 7. Jacks shall be offered in a minimum of thirteen colors.
 - 8. Modular jacks shall be Panduit, Hubbell, Belden or owner approved
- H. Audio/Video Connectors
 - 1. Provide complete connectivity and all media connectors as required by the drawings and the other specifications sections for a complete operating system.
 - 2. HDMI connectors
- I. Faceplates shall have the following minimum requirements:
 - 1. Shall come in 1-6 port modular openings, openings without jacks installed shall have blank inserts provided
 - 2. Jacks shall mount flush in plate.
 - 3. Label holder fields shall be located over each screw mounting hole.
 - 4. Captive screw feature for holding mounting screws and "Phillips Head" screws.
 - 5. Accepts front loading, snap-in jacks and connector fittings.
 - 6. Provide double gang plates are required per outlet details on drawings
 - 7. Provide clear plastic label holder.
 - 8. Plates for wall mounted phones shall be style 630.
 - 9. Ivory, confirm color with Architect
 - 10. Plastic Faceplates with required modular inserts and blanks shall be by Panduit, Hubbell, Belden or owner approved
- J. All outlets, faceplates, and modules shall be by one manufacturer.
- K. Each communication outlet will be numbered as follows:
 - 1. Each communications outlet shall be uniquely labeled. The label shall form an integral part of the faceplate. Labels shall be machine typed, not hand written. The Contractor shall verify and coordinate the labeling methods and nomenclature with the Owner Representative before beginning this work.
 - 2. All wireless access points and associated outlets shall be uniquely labeled. Labels shall be machine typed, not hand written. The Contractor shall verify and coordinate the labeling methods and nomenclature with the Owner's Representative before beginning this work.

2.04 HORIZONTAL DATA CABLING

- A. Provide horizontal distribution system to link the cross-connect system distribution field to the telecommunications outlet/connectors in the building.
- B. Dedicated CAT6 cables shall be provided for each outlet port. All CAT6 cables shall terminate in a single 8 position modular jacks at the work area telecommunications outlets. Pairs within a cable shall not be split and all pairs must be terminated.

- C. The installation of the horizontal cable shall follow the appropriate recommendations covered in the Manufacturer's Design Guide and the appropriate standards documents. Ensure adequate protection against Electro-Magnetic Interference (EMI) sources and ensure that all components and cables are in good condition after installation.
- D. Communication Outlet Cabling: The communications outlet/connector is the interface between the horizontal wiring and the work area telecommunications devices.
 - 1. See plans for communication outlet and configurations. All communication outlets shall be wired with cable quantities to match number of ports shown on plans.
 - 2. All data and voice ports shall be wired with CAT6 station wires, quantities to match number of ports shown on plan details. All components shall be rated for Category 6 applications.
 - 3. All data ports shall be wired with CAT6 cable, quantities to match number of ports shown on plan details. All components shall be rated for Category 6 applications, terminated at rack mounted patch panel with patch cord connection to associated edge switch. Provide one workstation patch cord per port.
 - 4. All voice ports shall be wired with one CAT6 cable as specified above, terminated at rack mounted patch panel with patch cord connection to associated PoE edge switch. Provide one workstation patch cord per port.
 - 5. Each wireless access point locations shall be wired with one CAT6 cable, as specified above, terminated at at rack mounted patch panel with patch cord connection to associated PoE edge switch. 20'-0" of spare cable shall be coiled, bundled, labeled and secured above the accessible ceiling at locations of access points shown on the floor plans. Cables shall be terminated with CAT6 jack for connection of a wireless access point. Provide patch cord for connection of wireless access point.
 - 6. Each CCTV camera shall have a single data port outlet to be wired with one CAT6 cable, as specified above, terminated at rack mounted patch panel with patch cord connection to associated PoE edge switch. See below and spec section 28 23 01 for further information
 - 7. All cables shall be routed to the existing communications closet. Cables shall be provided with RJ45 connector. Minimum of 10' of slack will be left neatly labeled, coiled, and tied in the closet.
 - 8. Terminate all cables at patch panels. Coordinate locations and organization with Owner.
- E. After each communication outlet is wired and the routed to communications closet, every conductor must be checked for shorts, crosses, reversals and for continuity. CAT6 data jacks shall also be checked for attenuation, capacitance, impedance, resistance, near-end crosstalk, cable length, ELFEXT, return loss delay, delay skew and ambient noise. See additional Testing Requirements in part 3 of this specification section.

2.05 COMMUNICATIONS OUTLETS

- A. Each communications outlet location shall be provided with devices as shown on drawings and specified herein. Contractor shall verify the color of all faceplates with the Architect before placing an order for these items. Modular connector colors shall be different colors for each system: Blue for data, and Gray for Wireless Access Points. Verify all colors with the Owner.
- B. Communications outlets/connectors (modular jacks) shall be provided as shown on the plans and provided with connection to the horizontal media. All communications outlet/connectors shall be installed complete in an appropriate box with proper faceplate, jacks and wiring.
- C. Flush communications outlets shall provide sufficient space to allow for up to a maximum of six connectors per single gang communications outlet and nine connectors per double gang communications outlet. Surface mount communications outlets shall provide up to four communications outlet/connectors.
- D. Face plates shall be clean in appearance. Mounting hardware shall not be visible on the faceplate
- E. The available modular telecommunications outlet/connectors shall include UTP 8 position CAT6 connectors. No additional mounting hardware shall be required to mount outlet/connectors into faceplate.

- F. All communications outlet faceplates shall be made of high impact 94 V-O Rated thermoplastic, confirm color with Owner prior to purchase.
- G. Modular jacks shall have the following features:
 - 1. Bifurcated contacts for exceptional spring force and tight contact.
 - 2. Jack contacts shall be made of Beryllium copper with a minimum of 50 micro-inch gold plating.
 - 3. Jack contacts shall be bi-plane staggered to improve crosstalk stability.
 - 4. Jack must be of a universal A & B wiring.
 - 5. Jack must be a fully automated product
 - 6. Jacks to have a holder plate so proper punch down is made.
 - 7. Jacks shall be offered in a minimum of thirteen colors.
 - 8. Modular jacks shall be Hubbell #HXJ6BK or Owner approved equal
- H. Faceplates shall have the following minimum requirements:
 - 1. Shall come in 4-6 port modular openings, openings without jacks installed shall have blank inserts provided
 - 2. Jacks shall mount flush in plate.
 - 3. Label holder fields shall be located over each screw mounting hole.
 - 4. Captive screw feature for holding mounting screws and "Phillips Head" screws.
 - 5. Accepts front loading, snap-in jacks and connector fittings.
 - 6. Provide clear plastic label holder.
 - 7. Ivory, confirm color with Owner
 - 8. Plastic Faceplates shall be Hubbell IFP26TI or Owner approved equal
 - 9. Blanks for Faceplates shall be Hubbell SFB110 or Owner approved equal
- I. Each communication outlet will be numbered as follows:
 - 1. Each communications outlet shall be uniquely labeled. The label shall form an integral part of the faceplate. Labels shall be machine typed, not hand written. The Contractor shall verify and coordinate the labeling methods with the Owner before beginning this work.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC) and the appropriate local codes. All cabling shall be (CMP) Plenum Rated.
- B. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code, 2023 and all appropriate local codes.
- C. Installation should be performed in a professional manner using the best practices in the industry.
- D. All data cabling shall be continuous and without splices from the outlets to the communications closet.
- E. All exposed, cabling is to be placed in a neat and professional manner and routed as per the manufacturer's specifications. All exposed cable bundles are to be wrapped with plenum rated Velcro at a maximum of every 36 inches. All cable-ties used shall be hand tightened only to a point where the sheath does not kink. Plastic cable ties are not acceptable.
- F. Conduits to the technology outlets are to be a minimum of one inch. A dedicated conduit will serve each outlet box. Conduit "stub ups" will extend 2' from the wall, angle to the center of the room which it feeds, and must have conduit bushings on the ends.
- G. Where J-hooks are allowed, above suspended ceilings in rooms, the Contractor shall bundle, in bundles of 10 or less, cables with plenum rated Velcro ties, snug, but not deforming the cable geometry. Cable bundling shall be supported via "J" hooks attached to the building structure and framework at a maximum of via (5) foot intervals. The intervals shall be staggered, so each spacing is not exactly 5'; 4'-6", then 4'-9", then 5', then 4'-9" and so on. J-Hooks shall be

Cooper B-Line or equals by ICC, MPHusky or Chalfant Co. J-Hooks can be double-sided. J-Hooks and cabling routing paths are to be coordinated with all other trades.

- H. J-hooks will be placed only above drop tile ceiling with a minimum clearance of 6" between T-bar and j-hook; at no time will the cable clearance be less than 3" to the T-bar. At no point, will the cable contact the ceiling or any other trades work. J-hooks shall not be placed more than 18" above drop ceiling
- I. J-hooks shall not be routed along walls, pathway will run to center of room and out to hallway if drywall is extended to ceiling a sleeved hole will be placed.
- J. Conduit will be used in inaccessible environments such as: drywall ceilings/walls or any location where pathway is not readily accessible. This includes but not limited to: above HVAC ductwork, lab counters, cabinets and height issues not being able to safely access pathway from a step ladder.
- K. J-Hooks and/or cable tray will not be placed above hard ceiling or areas where there is no access or limited access (HVAC ducts or piping) Pull boxes, if needed, must be accessible.
- L. The Contractor shall adhere to the manufacturers' requirements for bending radius and pulling tension of all data and voice cables.
- M. At no time is it acceptable to place any other low voltage cabling within any pathway intended for voice and data cabling. All audio/video cabling be routed in j-hooks and pathways separate from voice and data cabling.
- N. All cable pathway shall be placed parallel and perpendicular to building lines.
- O. The Contractor shall provide 4-inch conduit sleeves for penetrations in fire rated walls between areas for cable passage. Sealing of openings for cable pass through through rated fire and smoke walls, shall be the responsibility of the Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over his work. The firestopping provided for communication cabling shall be of a mechanical type to allow re-entry; see specification section 26 05 55. Creation of such openings as are necessary for cable passage between locations shall be the responsibility of the contractor's work. Any openings created by or for the contractor and left unused shall also be sealed as part of this work.
- P. The Contractor shall be responsible for damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.
- Q. The cables shall be labeled at both ends of the cable run near the connector. Additional labels shall be provided where the cable enters or exits the corridors.
- R. Any cabling that is kinked, stretched, punctured, ripped, twisted, discolored, deformed or painted (even overspray) will be removed and reinstalled at contractor cost, regardless if it passes testing.
- S. Maintain the following clearances from possible sources of Electromagnetic Interference exceeding 5 kVA:
 - 1. Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to grounded metal conduit pathway: 6"
 - 2. Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway: 12"
 - 3. Unshielded power lines or electrical equipment in proximity to open or nonmetal pathways: 24"
 - 4. Electrical motors and transformers: 47"
- T. All copper cables shall be handled, installed, and supported per the manufacturer's guidelines. During the laying of the cable, installer shall take care not to over stress the cable. After the cable is installed, the installer shall make sure that all parts of the cable are supported properly and shall be stress free throughout their length and at both ends.

- U. Appropriate attention shall be given to the handling of Category 6 UTP cables to ensure that their bending radius conforms to the manufacturer's requirements. At no time shall the cable's static or dynamic bending radius be exceeded as indicated below.
 - 1. CAT 6 cables shall have no more than a 1-inch bend radius
- V. No wire may be pulled until conduit is in place. Free ends and loops at boxes and enclosures pushed back in box and protected by blank covers or other means until the interior painting and decorating work is completed. Wire not so protected, if painted, to be removed and replaced by this Contractor at his expense.
- W. Grease or petroleum base lubricants shall not be used for lubricating wires for pulling.
- X. When securing cables Velcro style ties shall be used; plastic cable ties of any type are not acceptable.
- Y. Leave at least 6" free cables at outlets.
- Z. CAUTION: Very close attention must be paid in maintaining the twist of the pairs at both ends in all CAT6 wires. The twist must be within 1/2" of any termination point.
- AA. Communication outlet mounting height shall be at same height as electric outlets unless noted otherwise.
- AB. All 4 pairs of each UTP cable shall be terminated on a single port. The splitting of cable pairs between different jacks is not permitted. Terminating resistors required in certain applications shall be placed externally to the telecommunications outlet/connector.
- AC. Cable shall be provided on reels or boxes (reel in a box) to help eliminate kinks and twists.
- AD. All system components shall be rated for Category 6 applications.
- AE. All closets and terminal facilities must be free of cable clippings, empty reels, cartons or other refuse resulting from the installation at the end of each work day.

3.02 LABELING

- A. All telecommunications outlet/connectors, cables, etc. shall be labeled using a mechanically imprinted label or a system as defined by the Owner. Regardless of the numbering scheme, every cable shall have the same permanent identifier at both ends of its termination hardware.
- B. The cables shall be labeled at both ends of the cable run near the connector with the room number and port number. Additional labels shall be provided where the cable enters or exits the corridors. Markers shall be oil, abrasion and water resistant. Letters shall be black on white background, 1/8" high letters minimum.
- C. Each Technology Outlet will be identified with a unique identifier. Each outlet will be labeled with the IT room number which the cable terminates in, and a four digit number which the first number will identify the floor that the IT Room is on and a three digit following that.
- D. All numbering will be sequential and flow left to right on patch panels.
- E. Verify labeling of all wiring, outlets, etc. is in accordance with the Owner's preferred labeling scheme prior to implementation.
- F. Verify labeling of all wireless access points with Owner prior to implementation.
- G. All labeling scheme shall be included on record drawings.

3.03 TESTING

- A. Provide Verification, Inspection and Certification.
- B. System will not be acceptable until all components are tested for continuity, free from grounds, shorts, crossovers, and are determined to be functioning properly. Tests shall be witnessed by a representative of the architect and representative of Owner.
- C. The Owner will be given at least one week (5 working days) advanced notice for testing. This testing will be arranged through the Architect, at no time will contractor dictate the time/date for testing.

- D. To be tested the system must be complete, this includes all pathway, cabling dressed, labeling, faceplates secured and fire stopping.
- E. All testing will be done with a CCTT (Certified Cable Testing Technician); the CCTT shall perform all testing. The approved test instrument is the Fluke Versify™ (DSX-5000) or Owner approved equal.
- F. MARGINAL TESTS WILL NOT BE ACCEPTED.
- G. Test instrument shall be within its 12-month calibration period and have the latest software and firmware versions installed. If the test instrument is not within calibration period testing will not take place.
- H. Cable test record designations shall match the associated cable labels.
- I. Permanent Link test results, including individual frequency measurements, shall be recorded in the test instrument for subsequent uploading to a PC, using Fluke software, from which administrative documentation (testing reports) may be generated
- J. Owner will witness all setup and referencing of test instruments prior to testing.
- K. Provide written verification confirming that transmission performance testing and inspection has been completed and that all cable runs have passed. Also, document that all failures have been identified, corrected, and re-tested successfully.
- L. CAT6 Cables:
 - 1. End-to-end testing for UTP copper shall be conducted from both ends for 100% of pairs and shall identify pair reversal, opens, and shorts. The test results shall be documented, corrections implemented and retesting conducted and documented. In addition, documentation shall be presented to show the length of the cable between the Telecommunications Closet and the Work Area. Testing shall be per ANSI/TIA/EIA-TSB 568-B.2 (Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems.)
 - 2. Test requirements:
 - a. Wire Map
 - b. Length
 - c. Propagation Delay
 - d. Delay Skew
 - e. DC Loop Resistance – recorded for information only
 - f. DC Resistance Unbalance – recorded for information
 - g. Insertion Loss
 - h. PS NEXT (Power Sum Near-End Crosstalk)
 - i. NEXT (Near End Cross-Talk)
 - j. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End) – recorded for information only
 - k. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
 - l. ACR-F (Attenuation to Crosstalk Ratio Far-End)
 - m. ACR-N (Attenuation to Crosstalk Ratio Near-End) – recorded for information only
 - n. ELFEXT
 - o. PSELFEXT: Delay Skew, Delay, Return Loss, ACR, PSACR
 - p. Return Loss
 - q. TCL (Transverse Conversion Loss) – recorded for information only
 - r. ELTCTL (Equal Level Transverse Conversion Transfer Loss) – recorded for information only
 - 3. Testing shall be performed on each cabling segment (connector to connector). Sampling is not acceptable.
 - 4. Permanent Link adapters made from twisted pair Category 6 cords are not permitted as their performance degrades with use and can cause false Return Loss failures.

5. The installer shall build a reference link. All components shall be anchored so it is not possible to disturb them. The technician is to conduct a Category 6 Permanent Link test each day to ensure no degradation of the test instrument or its Permanent Link adapters.
 6. All installed cabling Permanent Links shall be field-tested and pass the test requirements and analysis. Any Permanent Link that fails these requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected Permanent Link meets performance requirements. The final and passing result of the tests for all Permanent Links shall be provided in the test results documentation.
- M. The detailed test results documentation data is to be provided in an electronic database for each tested balance twisted-pair and shall contain the following information:
1. The overall Pass/Fail evaluation of the link under test
 2. The date and time the test results were saved in the memory of the tester
 3. The identification of the customer site as specified by the end-user
 4. The name of the test limit selected to execute the stored test results
 5. The name of the personnel performing the test
 6. The version of the test software and the version of the test limit database held within the test instrument
 7. The manufacturer, model and serial number of the field-test instrument
 8. The adapters used and the factory calibration date
- N. Provide test results to A/E, Owner and in O&M manuals in hard copy form and electronic form as directed by the A/E.

END OF SECTION

SECTION 28 46 00 - FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Relocation of existing fire alarm system components, wiring, and conduit indicated.

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 72 - National Fire Alarm and Signaling Code; 2016.
- F. NFPA 101 - Life Safety Code; 2015.

1.03 SUBMITTALS

- A. Evidence of designer qualifications.
- B. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
 - 1. Copy (if any) of list of data required by authority having jurisdiction.
 - 2. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
 - 3. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
 - 4. List of all devices on each signaling line circuit, with spare capacity indicated.
 - 5. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
 - 6. Do not show existing components to be removed.
- C. Evidence of installer qualifications.
- D. Inspection and Test Reports:
 - 1. Submit documentation of satisfactory inspections and tests.
- E. Operating and Maintenance Data: Revise and resubmit until acceptable; have one set available during closeout demonstration:
 - 1. Complete set of specified design documents, as approved by authority having jurisdiction.
 - 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
- F. Project Record Documents: Have one set available during closeout demonstration:
 - 1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
 - 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
 - 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- G. Closeout Documents:
 - 1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
 - 1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 - 2. Installer Personnel: At least 2 years of experience installing fire alarm systems.

1.05 WARRANTY

- A. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Alarm Control Units - Existing System: Simplex.
- B. Each and every item of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriter's Laboratories, Inc. (UL), and shall bear the "UL" label. All control equipment shall be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.
- C. Initiating Devices and Notification Appliances:
 - 1. Simplex; to match existing system.
 - 2. Same manufacturer as control units.
 - 3. Provide initiating devices and notification appliances made by the same manufacturer, where possible.
- D. Substitutions are not acceptable

2.02 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide modifications and extensions to the existing automatic fire detection and alarm system:
 - 1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
 - 2. Protected Premises: MCES ERWRF Operations and Maintenance Building.
 - 3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
 - a. ADA Standards.
 - b. The requirements of the State Fire Marshal.
 - c. The requirements of the local authority having jurisdiction .
 - d. Applicable local codes.
 - e. Contract Documents (drawings and specifications).
 - f. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
- B. Circuits:
 - 1. Initiating Device Circuits (IDC): Class B, Style B; match existing.
 - 2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5; match existing.
 - 3. Notification Appliance Circuits (NAC): Class B, Style W; match existing.

2.03 EXISTING COMPONENTS

- A. Existing Fire Alarm System: Remove existing components indicated and incorporate remaining components into new system, under warranty as if they were new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected to existing system.

- B. Clearly label components that are "Not In Service."

2.04 FIRE SAFETY SYSTEMS INTERFACES

- A. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Area smoke detectors.
 2. Pull Stations
- B. HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

2.05 COMPONENTS

- A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
 2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.
- C. Initiating Devices:
1. Addressable Systems:
 - a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
 - b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.
 2. Manual Pull Stations: Addressable Unit meeting the following criteria.
 - a. Addressable pull stations shall contain electronics that communicate the station's status (alarm, normal) to the control panel. The address will be set on the station. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks. Pull stations will be double action.
 - b. The addressable manual station shall be capable of field programming of its "address" location on an addressable initiating circuit. The manual station shall be fitted with screw terminals for field wire attachment.
 - c. The front of the station to be hinged to a backplate assembly and be opened with a key to reset the station. The key shall be common with the control panels. Stations which use Allen wrenches or special tools to reset, with not be accepted. The station shall consist of high impact Lexan plastic, red in color.
 - d. Provide 10% spare, minimum of 1
 3. Smoke Detectors: Addressable Smoke Detector and Base meeting the following criteria:.
 - a. The Photoelectric type detector shall be a plug-in unit which mounts to a twist-lock base, and shall be UL approved.
 - b. The detectors shall be of the solid state photoelectric type and shall contain no radioactive material. They will use a pulsed infrared LED light source and be sealed against rear air flow entry. The base shall contain a magnetically actuated test switch.
 - c. The base will contain electronics that communicate the detector status (normal, alarm, trouble) to the control panel. Upon removal of the head, a trouble signal will be transmitted to the control panel. Detectors shall not require resetting or readjustment to restore to normal operation.
 - d. The detector shall be compatible with other addressable detectors, addressable manual stations, and addressable Interface adapter Modules on the same circuit.
 - e. Provide 10% spare, minimum of one.
- D. Notification Appliances:
1. Audible/Visual Combination Alarms:
 - a. Audible/visual units shall provide a common enclosure for the fire alarm audible and visual alarm devices. The housing shall be designed to accommodate horns. The unit

shall be complete with a tamper resistant, Pyramidal shaped clear Lexan lens with "Fire" lettering visible from a 180 deg. field of view. The front panel or bezel, is constructed of UL Listed Noryll, with audio and Visual Devices side by side. Integral Xenon strobe shall provide a minimum light output of 110 candela at 24VDC at a 1 to 1.5 flashes per second rate. Candela output shall be field adjustable. Xenon strobes shall provide a 4 wire connection to insure properly supervised in/out system connection. Unit shall be complete with all mounting hardware including backbox. Audio/visual unit shall be UL listed for its intended purposes and meet ADA Requirements. All visual signals shall be synchronized.

- b. Provide 10% spare, minimum of 1.
- 2. Visual Alarms:
 - a. The unit shall be complete with a tamper resistant, Pyramidal shaped clear Lexan lens with "Fire" lettering visible from a 180 deg. field of view. Integral Xenon strobe shall provide a minimum light output of 110 candela at 24 VDC at a 1 to 1.5 flashes per second rate. Candela output shall be field adjustable. Xenon strobes shall provide a 4 wire connection to insure properly supervised in/out system connection. Unit shall be complete with all mounting hardware including backbox. Visual unit shall be UL Listed for its intended purpose and meet ADA requirements and be synchronized.
 - b. Provide 10% spare, minimum of 1.
- E. End of Line Devices
 - 1. End of line device to be mounted in separate box and be flush mounted in ceiling in finished areas, surface mounted on wall or ceiling in unfinished areas. Locate near last device in zone. Provide engraved nameplate reading "E.O.L." and zone identification.
 - 2. End of line device and any adapter modules shall be listed in control panel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NEC, and the contract documents.

3.02 MOUNTING METHODS

- A. Exact location of fire alarm devices to be carefully coordinated with architectural features, piping, ductwork, doors, etc. and other obstructions prior to installation. Do not locate smoke detectors with-in 36" of an air device.
- B. Manual fire alarm stations to be semi-recess mounted on a 4" x 4" x 2-1/8" deep flush box with a single gang raised device cover.
- C. Addressable fire alarm heat and smoke detecting devices to be ceiling mounted on flush 4" octagon box.
- D. Addressable heat and smoke detectors to be surface mounted on a 4" x 4" x 2-1/8" deep octagon box, set flush with finish surface.
- E. Furnish and install any required collar or trim as required so alarm signal devices can be neatly mounted to existing walls and ceilings.

3.03 MOUNTING HEIGHTS

- A. Pull Stations: Top at 48" above finished floor
- B. Notification Signals (Strobes): Center line of lense between 80"-96" above finished floor.

3.04 WIRING

- A. All wiring to be run in a conduit system separate from all other systems. Contractor shall determine route and sizing as required by system manufacturer.
- B. All system wiring shall be standard, NEC type XHHW, 90° C insulation, No. 14 minimum or as required by the system manufacturer.

- C. All wiring quantities to be verified and installed in accordance with manufacturer's requirements and before the final conduit route is installed. All wires shall be tagged at each end and all junction points. All wires shall test free from grounds or crosses between conductors.
- D. All wires shall be terminated with ring or split terminal connectors.
- E. Final connection between equipment and the wiring system to be made under the direct supervision of a representative of the manufacturer.
- F. Existing wiring may be reused if it meets the manufacturer, code and specification requirements.

3.05 IDENTIFICATION

- A. Provide engraved wafer plastic nameplates for each "end-of-line" resistor location.
- B. Circuit wiring color to be red and black. Match existing wiring and maintain throughout system installation.
- C. Each conductor at all junction and termination points to be zone identified with self-adhesive markers.
- D. All junction boxes shall be sprayed red and labeled "Fire Alarm".

3.06 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 14 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- H. System demonstration shall include but not be limited to the following:
 - 1. Alarm Verification: Report by device, Pinpoint location, Device type identification and address
 - 2. Alarm/Trouble per device and component
 - 3. Full field programmability via compatible desktop or laptop computer: Address verify and change, Sensitivity verify and change, Pre-alarm level verify and change, Field changes shall upload to central panels, Field changes shall download from central panels
 - 4. Single-button building system control to: common alarm silence; silences existing and new systems in parallel
 - 5. Single-button building system control to: common reset; resets existing and new systems in parallel.
- I. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
 - 1. Record all system operations and malfunctions.
 - 2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
 - 3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
- J. System will not be accepted until all components and functions are demonstrated to be in full operation.

3.07 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
 - 1. Be prepared to conduct any of the required tests.
 - 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 - 3. Have authorized technical representative of control unit manufacturer present during demonstration.
 - 4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
 - 5. Repeat demonstration until successful.

END OF SECTION

SECTION 31 10 00 - SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

- A. Perform site-clearing work as shown and specified. Work includes:
 - 1. Protecting existing trees, plants, grasses and improvements designated to remain.
 - 2. Removing plants, lawns and vegetation where required.
 - 3. Clearing undergrowth, stripping weeds and other vegetation where required.
 - 4. Stripping and stockpiling topsoil.
 - 5. Removing designated above and below grade site improvements.
 - 6. Removing debris and waste materials.
- B. Related Sections: The following sections contain requirements that relate to this section.
 - 1. Division 01 General Requirements
 - 2. 31 20 00 Earth Moving
- C. Related Documents
 - 1. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 00 & 01 Specification Sections, apply to this Section.

1.1 QUALITY ASSURANCE

- A. Comply with all applicable City, State and Federal requirements regarding materials, methods of work and disposal of excess and waste materials.
- B. Obtain and pay for all required inspections, permits and fees. Provide notices required by governmental authorities.

1.2 PROJECT CONDITIONS

- A. Locate and identify existing underground and overhead utilities in areas of work. If utilities are to remain, provide adequate means of protection during site work operations. Repair utilities damaged during site work operations to satisfaction of utility owner and at Contractor's expense. Call local utilities protection service 72 hours prior to beginning work on site.
- B. Should uncharted or incorrectly charted underground piping or other utilities be encountered during site work operations, notify the applicable utility company and the Owner immediately for procedure directions. Cooperate with the applicable utility company in maintaining active services in operation.
- C. Locate, protect and maintain benchmarks, monuments, control points and project engineering reference points. Re-establish if disturbed or destroyed at Contractor's expense.
- D. Conduct site work operations and the removal of excess and waste materials to assure minimum interference with streets and other adjacent occupied or used facilities. Comply with City and State requirements for trucking of materials, including standing, parking, traffic routes and covering of open trucks.

- E. Do not close or obstruct streets and adjacent facilities without permission of authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways when required by governing authorities.
- F. Control dust caused by the Work. Moisten surfaces as required. Comply with pollution control regulations of governing authorities.
- G. Protect existing buildings, paving and other services or facilities, except items designated for removal, on site and adjacent to the site, from damage caused by site work operations. Cost of repair and restoration of damaged items at Contractor's expense.
- H. Protect and maintain streetlights, utility poles and services, traffic signal control boxes, curb boxes, valves and other services, except items designated for removal. Provide for temporary relocation when required to maintain facilities and services in operation during construction work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Materials and equipment: As selected by Contractor, except as indicated.
- B. Tree protection: Plastic fencing; standard orange plastic snow fence supplied in rolls, exposed height above grade to be 4 feet.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

- A. Clear areas only as required for access to new construction, site excavation and performance of the work. Refer to the drawings for contract limits.
- B. Examine existing trees and plants; suitably identify trees and plants to remain.
- C. Remove trees, brush, plants, undergrowth, other vegetative matter and debris from areas to be cleared and grubbed within contract limits. Strip weeds, lawns and heavy grass.
 - 1. Use only hand methods for grubbing inside the drip line of trees designated to remain. Strip existing grass plant materials to a maximum depth of 1 inch under tree canopies and carefully till or scarify existing grade to a maximum depth of 1 inch.
 - 2. Remove stumps 4" in diameter and larger to their full depth; remove 3 in. and larger roots to a depth of 2 ft. below finish grade; and remove 3 in. and larger roots within 5 ft. of an underground structure, utility line, footings, and paved areas.
- D. Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning or bruising of roots and bark, smothering of trees by stockpiling construction materials or excavated material within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Fires not permitted under or near trees and vegetation to remain.

1. Protect designated trees to remain with 48-inch high wood or orange plastic snow fence enclosure. Trees grouped together may be fenced together; see site plan.

<u>Trunk Diameter</u> greater than 10"	<u>Distance From Edge of Trunk to Outer Edge of Fencing</u> 10'
2. Planting beds to be installed under trees to remain must be hand dug and roots 2" in diameter and larger shall be protected from damage.
3. Water trees and other vegetation as required to maintain their health during the course of construction operations.
4. The Owner's Representative may remove interfering branches of trees subject to direction and approval.
5. Repair or replace trees and any other vegetation damaged by construction operations, in a manner acceptable to the Owner's Representative. Repair damaged trees promptly to prevent progressive deterioration.
6. The Owner shall receive a monetary settlement for damage to tree(s) designated to remain, which are damaged by the work of the Contractor. The amount of the settlement shall be the value of the tree(s) prior to construction, less the value of the tree(s) or their replacements at project acceptance. The monetary value of trees shall be as determined by the Shade Tree Valuation Handbook of the International Shade Tree Conference, latest edition. Repair and replacement of trees significantly damaged due to lack of adequate protection during work operations shall be at Contractor's expense.

3.2 DEMOLITION

- A. Demolish, remove, relocate or adjust designated site improvements. Remove foundations to a minimum of 3 ft. below finish grade for open areas and to the elevation indicated for areas to receive new structures. Remove all wood and metal construction.
 1. Existing foundations and slabs remaining below the cut-off elevation under new structures and not interfering with new construction may remain.
 2. Break foundations and slabs into sections not greater than 3 sq. ft. to provide drainage.
 3. Break floors of cisterns to provide drainage.
- B. Leave below grade voids open and clean. Fill material will be provided and grading performed under Division 31 Section "Earthwork".
- C. Remove existing sidewalks, curbs and paving including all base material as required to permit new construction and as indicated on the drawings.
- D. Remove existing above and below grade site improvements as indicated on the demolition plan.
- E. Remove existing trash and debris from indicated areas.

3.3 EXISTING UTILITIES

- A. Perform all work and provide materials necessary to disconnect and remove or relocate existing utilities as indicated. Record existing piping termination prior to disconnection or relocation.
- B. Information on the drawings relating to existing utilities services and other structures

is from the best sources presently available. All such information is furnished only for information and is not guaranteed. Excavate test pits as required to determine exact locations.

- C. Completely fill pipes indicated to be plugged with an 8-inch thick concrete plug or mortar jointed masonry bulkhead.

3.4 SALVAGED MATERIALS

- A. Store and protect material scheduled for reuse and relocation.
- B. All material resulting from site preparation work and not scheduled for reuse, relocation or salvaged for Owner use are property of the Contractor. Promptly remove from the site as materials accumulate.

3.5 WASTE MATERIALS

- A. Stockpile, haul from site and legally dispose of waste materials and debris.
- B. Maintain street and disposal routes clear, clean and free of debris.
- C. On-site burning of combustible cleared materials.
 - 1. There will be no on-site burning permitted.

3.6 CLEANING

- A. At completion of work, clean entire area within designated limits and leave site clear, clean and free of rubbish and debris ready for excavating, filling and grading.

END OF SECTION 31 10 00

SECTION 31 20 00 - EARTH MOVING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Perform earthwork as shown and specified. Work includes:
 - 1. Topsoil stripping and stockpiling
 - 2. Site grading and filling to attain proposed grade elevations.
 - 3. Filling voids below grade resulting from site preparation work.
 - 4. Subgrade preparation for building slabs and pavements.
 - 5. Structure excavation and backfill.
 - 6. Topsoil distribution and finish grading.
 - 7. Disposal of surplus and waste materials.
- B. Related Work:
 - 1. Section 01 22 50: Unit Prices and Alternates
 - 2. Section 03 30 00: Cast-in-Place Concrete
 - 3. Section 22 14 13 Facility Storm Drainage
 - 3. Section 32 93 00: Plants

1.2 SUBMITTALS

- A. Provide samples of excavated material, fill material, geogrid or geotextile, granular material, and topsoil (both on-site and imported) proposed for use. Forward samples to testing laboratory for testing as required. Materials used in the work shall be the same as those tested. Do not use proposed materials until test reports have been reviewed by the Architect and approved. Recent test reports available for proposed materials will be acceptable in lieu of samples.
- B. Test Reports: Submit test reports as specified further in this Section.
- C. Submit, for Architect's approval, the manufacturers' recommended installation procedures for each type of drainage or utility piping conduit. This shall also include the recommended bedding material for each condition encountered. When approved, these procedures and materials shall become the project standard and shall become the basis for inspecting and accepting or rejecting the work.

1.3 QUALITY ASSURANCE

- A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.
- B. Testing and Inspection Service: A qualified independent geotechnical engineering testing agency acceptable to the Architect and Owner will classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing, in accordance with Section 01 45 23.

1.4 JOB CONDITIONS

- A. Protect existing trees, plants, lawns and other features designed to remain as part of the Work.
- B. Protect excavations by shoring, bracing, sheeting, underpinning or other methods, as required to prevent cave-ins or loose dirt from entering excavations. Baricade open excavations and post warning lights at work adjacent to streets.
- C. Underpin adjacent structures, including utility and service lines, which may be damaged by excavation work.
- D. Provide for safe passage of persons around the area of excavation.
- E. Promptly repair damages to adjacent facilities caused by earthwork operations. Cost of repair at Contractor's expense.
- F. Promptly notify Owner of unexpected sub-surface conditions. Discontinue work until notification to resume work is provided by the Owner.
- G. Protect bottoms of excavations and soil beneath and around foundations from frost and freezing.
- H. Grade around excavations to prevent surface water runoff into excavated areas.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All topsoil, fill and backfill material subject to inspection, testing and approval.
- B. All materials must comply with minimum requirements of authorities having jurisdiction.
- C. Imported Topsoil:
 - 4. Provide fertile, friable, native, surface soil, reasonably free of subsoil, clay lumps, brush, weed and other litter and free of roots, stumps, stones, and other extraneous or toxic matter harmful to plant growth.
 - 5. Topsoil shall be a sandy loam or loam soil as defined by the Soil Conservation Service U.S.D.A. Soil Classification System.
 - 6. Mechanical analysis shall fall within the following particle ranges:

<u>Average percentage</u>	<u>Range</u>	
Sand (0.05-2.0 mil dia. range)	30-70%	50%
Silt (0.002-0.05 mil dia. range)	20-50%	35%
Clay (less than 0.002 mil dia. range)	5-20%	15%

95% of topsoil shall pass a 2.0 mil sieve.
 - 7. Provide topsoil free of stones one inch in longest dimension, earth clods, plant parts and debris.
 - 8. Topsoil shall possess from 5% to 12% organic matter.
- D. On-site fill: Clean soil or soil-rock mixture free of foreign materials, organic material and debris. Suitable excavated materials removed to accommodate new construction may be used for fill, subject to approval.
- E. Imported fill: Clean, natural sandy-clay subsoil or soil-rock mixture, free of foreign matter, organic material, debris, or expansive soils. Designate borrow area. Material subject to approval.
- F. Geogrid or Geotextile Fabrics: ODOT 712.09 geotextile fabric, Type D. Spun or woven, strong, rot-proof polymeric fiber fabric, manufacturer certified to meet

- ODOT specification requirements or equivalent.
- G. Granular backfill: AASHTO M 43 #10 crushed stone or gravel grits, except as otherwise indicated on drawings.
- H. Granular backfill for subgrade stabilization: ODOT #304 crushed aggregate.
- I. Pipe bedding and cover fill: Clean natural river sand, bank sand, or red sand free of rubble and rocks of 1" diameter or more, or material as recommended by pipe manufacturer. Bedding subject to approval.
- J. On-Site topsoil: Natural topsoil stripped from the project site.
- K. Other materials required for proper completion of work: As selected by Contractor, subject to the Architect's approval.

PART 3 EXECUTION

3.1 GENERAL

- A. Examine areas and conditions under which work is to be performed.
- B. Consult the Soils Report for subsurface findings and earthwork recommendations in areas of existing, unsuitable sub-soils.
- C. Consult the records and drawings of adjacent work and of existing utilities and their connections for conditions which may affect the work under this Section.
- B. Establish extent of grading and excavation by area and elevation; designate and identify datum elevation. Set required lines and levels.
- C. Do not cover or enclose work of this Section prior to obtaining required inspections, tests and approvals and location recording.
- D. Where conduit must be routed through an area of existing tree roots, boring shall be used under the limits of the tree canopy to minimize disturbance of the root zone except as approved in writing by the Owner's Representative.
- E. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 UTILITIES

- A. Before starting grading and excavation, verify the location and extent of underground utilities in the work area. Exercise care to protect existing utilities during earthwork operations. Perform excavation work at utilities by hand and provide necessary shoring, sheeting and supports as the work progresses.
- B. Maintain, protect, re-route or extend as required existing utility lines to remain which pass through the work area. When such work is not shown on the drawings, costs for re-routing or extending existing utility lines (unless covered by the utility companies) will be paid for as a change in work. Obtain Owner's written authorization prior to performing extra work.
- C. Protect active utility services uncovered by excavation.
- D. Remove abandoned utility service lines from areas of excavation. Cap, plug or seal such lines and identify at grade.
- E. Accurately locate and record abandoned and active utility lines re-routed or extended on Project Record Documents.

3.3 SITE GRADING

- A. Perform grading within contract limits, including adjacent transition areas, to new elevations, levels, profiles and contours indicated. Insure subgrade surfaces are parallel to finished surface grades. Provide uniform levels and slopes between new elevations and existing grades.
- B. Grade to assure areas drain away from structures and to prevent ponding of surface drainage. Provide subgrade surface free from irregular surface changes and as follows:
 - 1. Rough grading: plus or minus 0.10 ft. subgrade tolerance. Degree of finish required will be that ordinarily obtained from either blade grader or scraper operations.
 - 2. Subgrade surface shall be free of exposed boulders or stones exceeding 4 inches in greatest dimension in paved areas; 2 inches in lawn areas.
 - 3. Fill all areas of settlement to proper grade prior to subsequent construction.
 - 4. Planting areas: Allow for 12 in. depth at planting areas (shrub beds). Hand excavate around existing trees to remain to attain new finished grades. Consult with Owner's Representative prior to this portion of the work.
 - 5. Paved Areas: Shape surface of subgrade areas to line, grade and cross-section indicated. Provide compacted subgrade suitable to receive paving base materials. Subgrade tolerance plus 0, minus ½ in.
- C. It is not intended that the earthwork be balanced on site. The Contractor shall provide additional imported fill or remove excess excavated material as required to achieve the grades shown on the drawings. (Dispose of excess excavated material in a manner described further in the Section.)

3.4 EXCAVATION: GENERAL

- A. Excavate for structures to elevations and dimensions shown. Extend excavation a sufficient distance from foundations to permit placing and removal of formwork, installation of materials, services, and inspection. Hand trim foundation excavations to final grade just before concrete is placed. Remove loose, soft materials and all organic matter. Foundations shall bear on tested and approved bearing soil or bedrock as shown on the Drawings.
- B. Obtain inspection and approval of foundation excavations by Soils Engineer and governing authorities before concrete is placed.
- C. Excavate for pavements, curbs, and walls to cross-sections, elevations and grades indicated. Allow for paving base material.
- D. Excavation is unclassified, i.e. excavation shall include the satisfactory removal and disposal of all materials, other than bedrock, encountered regardless of the nature of the materials, the conditions of the materials at the time they were excavated, or the manner in which they are excavated.
- E. Extra excavation: Excavate unsatisfactory soil materials extending below required elevations to depth as directed. Such extra excavation will be paid for as a change in work at the unit price bid for Excavation. Obtain Owner's written authorization prior to performing extra excavation work.
- F. Unauthorized excavation: Backfill and fill all over excavation to proper grades.

Fill over excavation at footings with concrete. Additional labor and material for unauthorized excavation at Contractor's expense.

- G. Shore, sheet or brace excavations as required to maintain them secure; remove shoring as backfilling progresses, when banks are safe against caving.
- H. Do not excavate footings or slabs to the full depth when freezing temperatures may be expected, unless footings or slabs are placed immediately after the excavation has been completed. Protect excavations bottoms from freezing if the placing of concrete is delayed.

3.5 ROCK EXCAVATION

- A. Rock: Material that cannot be removed with $\frac{3}{4}$ cubic yard capacity power shovel without drilling or blasting or solid boulders with a volume of more than $\frac{1}{2}$ cubic yard.
- B. Rock Excavation: Material excavation of buried boulders and rock in excess of $\frac{1}{2}$ cubic yard that required continuous and systematic drilling and blasting or continuous use of a ripper or other special equipment. All other excavation shall be classified as earth excavation.
- C. Contractor will be paid for cost of rock excavation as a change in work. Obtain Owner's written authorization prior to performing rock excavation work.
- D. Cut away rock in bottom of excavations to form level beds that follow natural strata. Form with sharp steps. In utility trenches, excavate to 6 in. below invert elevation to pipe and 24 in. wider than pipe diameter.

3.6 SITE DRAINAGE EXCAVATING

- A. Excavate banks of trenches as nearly vertical as possible to the line of narrow trench limit.
- B. Trim and shape trench bottoms to exact line and grade, free of irregularities, lumps and projections.
- C. Provide trench dimensions as indicated. Allow for proper installation of services and inspection.
- D. In areas where soft, unstable materials are encountered at the surface upon which the granular material or conduit is to be placed, remove the unstable material and replace it with material approved by the Architect. Make sufficient depth to develop a firm foundation for the item being installed. If the need for such over-excavation has been occasioned by an act or failure to act on the part of the Contractor, make the over-excavation and replacement at no additional cost to the Owner.
- E. Shaping:
 - 1. At each joint in pipe, recess the bottom of the trench as required into the firm foundation in such a manner as to relieve the bell of the pipe of all loads and to ensure continuous bearing of the pipe barrel on the firm foundation.
 - 2. Accurately shape all pipe subgrade and fit the bottom of the trench to the pipe shape. Use a drag template shaped to conform to the outer surface of the pipe if other methods do not produce satisfactory results.

3.7 PUMPING AND DRAINAGE

- A. Provide necessary pumps, hose and drainage lines and maintain all excavations, including footings and pits, free from water, ice and snow at all times during excavation, concrete work and paving work.
- B. Maintain ground water in the bearing soil strata at a safe level at all times by methods which prevent loss of fines and other disturbance to these strata. If the methods employed prove inadequate and the bearing value of the soil is reduced, the disturbed soil shall be removed as directed and replaced with concrete at the Contractor's expense.
- C. Provide drainage of the working area at all times.
- D. At the beginning of the work, provide a drainage system sufficient to maintain the site in good working condition. Such system may be of temporary nature or may include portions of the permanent drainage system, but in any case, shall provide for protection of the site from surface and subsurface flows.

3.8 GENERAL FILLING AND BACKFILLING

- A. Obtain inspection and approval of subgrade surfaces by Soils Engineer or landscape Architect prior to filling operations. Scarify, dry and compact soft and wet areas: remove and replace unsuitable subgrade materials with compacted fill material as directed.
- B. Spread approved fill material in layers not greater than 8 inches of un-compacted thickness. Do not use muddy or frozen fill materials. Do not place fill material on muddy or frozen ground.
- C. Moisture condition fill materials as required by aerating or watering and thoroughly mix material to obtain moisture content permitting proper compaction.
- D. Compact each layer of fill material to at least the scheduled density requirement: repeat until plan grade elevation is attained.
- E. Use hand tampers or vibrating compactors at locations inaccessible to large equipment and rollers. Do not use rolling equipment adjacent to foundations.
- F. Do not backfill against foundation or retaining walls until floor slab is in place or walls for bearing surfaces have reached design strength and are properly braced and backfilling operations approved. Provide granular fill material for interior backfill material and granular fill or other approved backfill material at exterior areas.
- G. areas.
- H. Soil Stabilization: In the event exposed natural subgrade surfaces become spongy and pump during construction operations, or if the existing subgrade materials are determined to be unstable, subgrade materials are to be stabilized as directed by the Architect. Soil stabilization will be paid for as a change in work at the unit prices included on the Bid Form for Excavation, Geogrid Stabilization and Granular Backfill. Obtain Owner's written authorization prior to performing soil stabilization work.

3.9 BACKFILLING FOR SITE DRAINAGE & UTILITIES

- A. Place and compact bedding course as recommended by piping manufacturer

and approved by Architect. Also conform to minimum requirements of authorities having jurisdiction.

- B. Carefully compact material under pipe haunches and bring material evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system. Bring material up to a minimum depth of one foot above the outside diameter of the pipe barrel.
- C. After the pipe has been thoroughly bedded and covered, spread the approved on-site material in uniform lifts of not more than 8 inches in uncompacted thickness, and then compact as specified. Repeat the spreading and compacting procedure until adjacent grade level is attained.
- D. If pipe occurs under pavements, after the pipe has been thoroughly bedded and covered, fill the remaining portion of the trench with granular material, and compact as specified.
- E. Concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches (450 mm) of footings. Place concrete to level of bottom of footings.
- F. Where pipe is specially coated for protection against corrosion, exercise care to avoid damage to the coating.
- G. Do not backfill against drainage structures until services have been inspected. Concrete shall have been in place for at least 7 days. Mortar joints and plaster coating of masonry structures and mortar joints of precast manhole sections shall be thoroughly set and shall have been in place at least 3 days. Backfill shall be deposited in horizontal layers, not over 8 inches in compacted thickness uniformly spread and compacted to the specified density. Take special precautions to prevent wedging action against the walls of structures.
- H. When compacting by rolling or operating heavy equipment parallel with the pipe, exercise care to prevent displacement of, or injury to, the pipe. Movement of construction machinery over drainage lines at any stage of construction shall be at the Contractor's risk. Any pipe impaired or damaged shall be replaced or repaired as directed by the Architect at Contractor's expense.

3.10 GRADING AT EXISTING TREES TO REMAIN

- A. Minor fills of 6 inches or less: Remove vegetation within drip-line perimeter. Fill with single layer of uncompacted topsoil; hand grade to required finish grade elevation.
- B. Carefully hand grade at all existing trees to remain..

3.11 COMPACTION

- A. Provide compaction control for all fill and backfill. Field compaction tests and related laboratory analysis shall be performed by a qualified independent laboratory, a member of the American Society for Testing and Materials, under the supervision of a registered Professional Engineer specializing in soils engineering. Soils proposed for fill and backfill shall be analyzed by the Soils Engineer.
- B. Compact top 12 inches of subgrade and each layer of fill or backfill material at foundations, retaining walls, building slabs and paved areas to a density of 98%

at optimum moisture content in accordance with ASTM D 698 Standard Proctor Method.

- C. Compact top 6 in. of subgrade 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 D 698 Standard Proctor Method.
- D. Compact fill and backfill material for utility trenches within building and pavement areas and extending minimum five feet beyond building and pavement areas to a density of 98% at optimum moisture content in accordance with ASTM D 698 Standard Proctor Method.
- E. Compact fill and backfill material for utility trenches within lawn areas to a density of 90% at optimum moisture content in accordance with ASTM D698 Standard Proctor Method.
- F. Puddling or jetting of fill and backfill material as a compaction method is not permitted.

3.12 FINISH GRADING

- A. Uniformly distribute and spread topsoil in areas designated on plan. Use topsoil in loose dry state. Do not use frozen or muddy topsoil. Place during dry weather.
- B. Fine grade all topsoil areas eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles and contours of subgrades. Finish grade shall not vary more than 1" from the plan grade.
- C. Remove stone, roots, weeds and debris while spreading topsoil materials. Provide surfaces suitable for soil preparation provided under planting work.

3.13 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.

3.14 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.
- B. Excess topsoil shall remain the property of the owner. The Contractor shall move it out of the immediate project area and to a permanent stockpile location as directed by the Owner.
- B. Maintain disposal routes clear, clean and free of debris.

3.15 TESTING

- A. Foundation excavations: Provide bearing tests in locations and spacing as directed by the structural engineer. Based on visual examination at the site, provide additional bearing tests as required to verify bearing surfaces are adequate

- and meet or exceed design bearing values.
- B. Fill material and granular base materials: Test proposed materials to verify suitability for use, gradation of material, moisture-density relation by ASTM D 698 Standard Proctor, and percent of organic materials.
 - C. Topsoil: Test proposed material to determine mechanical analysis, organic content, and Ph level.
 - D. Subgrade surfaces: Based on visual examination at the site, provide bearing tests as required to verify subgrade surfaces are adequate and meet or exceed design bearing values.
 - E. When, during progress of work, field tests indicate that installed compacted materials do not meet specified requirements, remove defective materials, replace and retest at Contractor's expense, as directed by the Owner.

END OF SECTION 31 20 00

SECTION 32 12 00

FLEXIBLE PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The extent of asphaltic concrete paving work is shown on the drawings. Asphaltic Concrete paving shall include:
 - 1. Prepare subgrade to receive base course materials for asphaltic concrete pavements.
 - 2. Place and compact base course materials (ODOT #304).
 - 3. Plane existing asphalt surfaces to accommodate transition to resurfaced asphalt pavement surface as called for on the drawings (ODOT #254).
 - 4. Tack existing asphalt pavement areas to receive surface course (ODOT #407).
 - 5. Intermediate course asphaltic concrete (ODOT # 448).
 - 6. Surface course asphaltic concrete (ODOT # 448).
 - 7. Joints filled.
 - 8. Pavement markings (ODOT #642).
- B. RELATED WORK
 - 1. Section 31 20 00: Earth Moving

1.2 QUALITY ASSURANCE

- A. Comply with materials and methods of construction requirements of the Ohio Department of Transportation Construction and Material Specifications, (ODOT), referenced sections only.
- B. Provide asphalt materials furnished by bulk asphalt concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete paving materials.
- C. Tolerances:
 - 1. In-place compacted thickness:
 - a. Intermediate course: 2 inch plus, minus 0.
 - b. Surface course: 1/4 inch plus, minus 0.
 - 2. Finished surface smoothness.
 - a. Intermediate course: Maximum 3/8 inch in 10 feet.
 - b. Surface course: Maximum 1/4 inch in 10 feet.

1.3 SUBMITTALS

- A. Submit data identifying types, sources and installer of materials proposed for the work.

1.4 JOB CONDITIONS

- A. Establish and maintain required lines and grade elevations for each course, including cross slopes as required.
- B. Protect adjacent work from damage, soiling, and staining.
- C. Provide temporary barriers and warning lights as required for protection of project work and public safety.

1.5 WEATHER LIMITATIONS

- A. Apply tack coat only when the ambient temperature in the shade is above 50 deg. F and when the temperature has not been below 35 deg. F for twelve hours immediately prior to application. Also do not apply when the base surface is wet or frozen or contains an excess of moisture which would prevent uniform distribution.
- B. Construct asphalt concrete surface course only when atmospheric temperature is above 50° F, when the underlying base is dry, and when weather is not rainy. Intermediate course may be

placed when air temperature is not below 40° and rising, when acceptable to Landscape Architect.

PART 2 - PRODUCTS

2.1 ASPHALT PAVEMENT MIX

- A. Combine mineral constituents in proportions to produce a mixture conforming to following gradation requirements:

1. Intermediate Course (ODOT #448): Course limestone aggregate (No. 67 or a blend of No. 6 and No. 8) and fine aggregate shall be combined in a blend as follows:

Sieve	Total Passing, % by Weight
1 inch	100
3/4 inch	90 - 100
1/2 inch	65 - 90
No. 4	35 - 65
No. 16	15 - 45
No. 50	3 - 22
No. 200	0 - 8

Bitumen (Percent of total mix) 4.0 - 12.0

2. Surface Course (ODOT # 448): Course limestone aggregate (No. 8) and fine aggregate shall be combined in a blend as follows:

Sieve	Total Passing, % by Weight
2 inch	100
3/8 inch	90 - 100
No. 4	45 - 75
No. 16	15 - 46
No. 50	3 - 22
No. 200	0 - 8

Bitumen (Percent of total mix) 4.5 - 12.0

2.2 TACK COAT - SS1 OR SS1H - APWA 2204

2.3 AGGREGATE BASE

- A. Angular pit run crushed natural carbonate stone; free from shale, clay, and friable materials and debris; graded within following limits: (ODOT # 304)

Sieve	Total Passing, % by Weight
2 inches	100
1 inch	70 - 90
3/4 inch	50 - 85
No. 4	25 - 60
No. 40	7 - 30
No. 200	0 - 15

2.4 JOINT FILLER

- A. Hot Applied Joint Sealer ASTM D 3405 (ODOT 705.04)

2.5 AUXILIARY MATERIALS

- A. Pavement Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed,

non-bleeding traffic paint complying with FS TT-P-1952, with drying time of less than 3 minutes.

1. Color: White.

PART 3 - EXECUTION

3.1 ASPHALTIC CONCRETE PAVEMENTS

- A. All areas shown on drawings to receive new asphaltic concrete paving shall receive the following treatment:
 1. Grade and compact subgrade as required. Before placing base course and paving, check subgrade and do all necessary rolling and compacting to obtain firm, even surface. Fill and consolidate any dented or depressed areas. Remove non-compactable material, replace with clean fill and compact solidly.
 2. Install crushed aggregate base in uniform courses; depth and number of courses required shall be as shown on the drawings.
 3. Compact each course of crushed aggregate in accordance with ODOT 304, until a satisfactory, firm sound base course has been established.
 4. Install asphaltic concrete intermediate course (ODOT #448) and asphaltic concrete surface course (ODOT #448) of the required depth (when compacted) to all asphaltic concrete pavement areas as shown and detailed on the drawings.
 5. Care shall be taken to neatly finish exposed edges and surfaces of asphalt paving to conform to lines and grades shown on drawings.
 6. Joints shall be sealed where asphaltic concrete pavement abuts concrete pavement, concrete curbs and drainage or manhole structures. The Contractor shall fill any resulting joints with sand to within 2" of surface of pavement. The upper 2" shall be filled with bituminous material. Care shall be taken in filling this joint so that no bituminous material comes in contact with exposed concrete surfaces.
 7. Laying temperature of all asphaltic concrete shall be 300° +/- 20°F.
- B. All areas shown on the drawings to receive asphaltic concrete resurfacing shall receive the following treatment:
 1. Plane tapered transitions between areas shown to be resurfaced and areas not to be resurfaced to achieve flush joints, as indicated on the drawings.
 2. Remove areas with excessive cracking as directed by the Landscape Architect. Repair these areas as specified for new asphaltic concrete paving.
 3. Clean all areas to be resurfaced to remove all loose material.
 4. Patch all depressions, and low areas by applying tack coat and a "scratch coat" of asphaltic concrete surface course material (ODOT #448) to bring the pavement to a uniform surface.
 5. Apply tack coat (ODOT #407) to all areas to be resurfaced.
 6. Install asphaltic concrete surface course (ODOT #448) minimum 1 ½" thick (compacted thickness) to all areas to be resurfaced. Coordinate this installation with installation of surface course on adjacent new asphaltic concrete paving.
 7. Care shall be taken to neatly finish exposed edges and surfaces of asphalt resurfacing.
 8. Joints shall be sealed where asphaltic concrete pavement abuts concrete pavement, concrete curbs and drainage or manhole structures. The Contractor shall fill any resulting joints with sand to within 2" of surface of pavement. The upper 2" shall be filled with bituminous material. Care shall be taken in filling this joint so that no bituminous material comes in contact with exposed concrete surfaces. Seal joints between resurfaced asphalt and existing asphalt.
 9. Laying temperature of all asphaltic concrete shall be 300° +/- 20°F.

3.2 COMPACTING THE MIX

- A. Begin rolling operation soon after placing when the mixture will bear the weight of the roller without excessive displacement. Do not suddenly change the line or direction of rolling.

- B. Compact the mixture with hand tampers or vibrating plate compactors in all areas inaccessible to rollers.
- C. Do not permit heavy equipment, including rollers, to stand on the finished surface before it has thoroughly cooled or set.

3.3 PAVEMENT MARKING

- A. Do not apply pavement marking paint until layout, colors, and placement have been verified with the Architect.
- B. Allow paving to age 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight lines. Apply at manufacturer's recommended rates, to provide a minimum wet film thickness of 15 mils.

3.4 PATCHING

- A. Remove and replace mixtures that become mixed with foreign materials and all defective areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to the required surface density and smoothness.
- B. Remove deficient areas for the full depth of the course. Cut sides perpendicular and parallel to the direction of traffic with edges vertical. Apply a tack coat before placing asphalt concrete mixture.

3.5 PROTECTION AND CLEANING

- A. Protect asphalt paving from construction and vehicular damage until project acceptance.
- B. Sweep asphalt paving and wash free of stains, discolorations, dirt and other foreign material immediately prior to project acceptance.

END OF SECTION 32 12 00

SECTION 32 32 23 - SEGMENTAL RETAINING WALL

PART 1 GENERAL

1.01 SUMMARY

- A. The work covered by this section includes the furnishing of all labor, materials, equipment, inspection and construction of a modular concrete Segmental Retaining Wall ("SRW") including drainage system and geosynthetic reinforcement. The work included in this section consists of, but is not limited, to the following:
1. Excavation and foundation soil preparation.
 2. Furnish and placement of the Leveling Base.
 3. Furnish and placement of the Drainage system.
 4. Furnish and placement of Geotextile Fabric.
 5. Furnish and placement of SRW units.
 6. Furnish and placement of Geosynthetic Reinforcement.
 7. Furnish, placement, and compaction of Backfill and Drainage Aggregates
 8. Furnish final grading.

1.02 REFERENCES

- A. ASTM International, latest edition:
- Segmental Retaining Wall Units
1. C 33, Standard Specification for Concrete Aggregates
 2. C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
 3. C979, Standard Specification for Pigments for Integrally Colored Concrete.
 4. C1372, Standard Specification for Dry-Cast Segmental Retaining Wall Units
- Aggregate Materials
1. C33, Standard Specification for Concrete Aggregates
 2. D448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction
 3. D2940, Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports
- Geotextile Fabric
1. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity
 2. D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile
- Soils
1. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))
 2. D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- Drainage Pipe
1. D3034, Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe
 2. F667, Standard Specification for Large Diameter Corrugated Polyethylene (PE) Pipe and Fittings

1.03 SUBMITTALS

- A. Segmental Retaining Wall:
1. Samples for verification: Three representative full-size samples of SRW. Thickness, color and finish that indicate the range of color variation and texture expected upon project completion.

2. Accepted samples become the standard of acceptance for the product produced.
 3. Test results from an independent testing laboratory for compliance of concrete pavers with ASTM C1372.
 4. Manufacturer's catalog product data, installation instructions, and material safety data sheets for the safe handling of the specified materials and products.
- B. Adhesive and Sealant:
1. Provide manufacturer's technical data sheets indication the physical properties and performance.
 2. Test results from an independent testing laboratory indicating the product strength.
- C. Geotextile Fabric
1. Provide product data sheets.
 2. Provide three representative samples 6in by 6in.
- D. Geosynthetic Reinforcement (Geogrid):
1. Provide product data sheets.
 2. Provide three representative samples 8in by 12in.
- E. Wall Installation Contractor:
1. Job references from a minimum of three projects similar in size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, fax, and email address.
 2. Furnish sealed construction documents with detailed structural design calculations.

1.04 QUALITY ASSURANCE

- A. Utilize a Manufacturer having at least ten years of experience manufacturing concrete SRW on projects of similar nature or project size.
- B. Source Limitations:
1. Obtain SRW from one source location with the resources to provide products of consistent quality in appearance and physical properties.
 2. Obtain Drainage Aggregate and Backfill Aggregate from one source.
 3. Obtain only natural Base and Subbase Aggregates quarried from an approved supplier. Recycled Crushed Concrete Base and Crushed Concrete Subbase Aggregates are not acceptable.
- C. SRW Contractor Qualifications:
1. Utilize an installer having successfully completed SRW installation similar in design, material, and extent indicated on this project.
- D. Mockups:
1. Install a 5 linear foot x 2 foot tall SRW.
 2. Use this area to determine installation tolerances. This area will serve as the standard by which the workmanship will be judged.
 3. Subject to acceptance by owner, mock-up may be retained as part of finished work.
 4. If mock-up is not retained, remove and dispose legally.

1.05 DELIVERY, STORAGE & HANDLING

- . Deliver SRW in manufacturer's original, unopened and undamaged container packaging with identification labels intact.
1. Coordinate delivery and SRW schedule to minimize interference with other construction activities.
 2. Unload SRW at job site in such a manner that no damage occurs to the product or adjacent surfaces.
 3. Store materials in accordance with manufacturer's recommendations and in a manner to prevent damage.

1.06 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:

1. Install Leveling Base Aggregates only over unfrozen and dry subgrade soils.
 2. Install Universal Base Units only when temperature is above 32 degrees Fahrenheit (0 degrees Celsius).
 3. Install SRW on Universal Base Units only over unfrozen and dry subgrade soils.
- B. Weather Limitations:
1. Install only when no heavy rain or snowfalls are forecast within 24 hours.

1.07 SRW OVERAGE AND ATTIC STOCK

- A. Provide a minimum of 5% additional material for overage to be used during construction.
- B. Contractor to provide 10 face feet of each product and size used to owner for maintenance and repair. Furnish SRW from the same production run as installed materials.
- C. Manufacture to supply maintenance and reinstatement manuals for SRW units.

PART 2 PRODUCTS

2.01 SEGMENTAL RETAINING WALL ("SRW") AND COPING

- A. Basis-of-Design Product: SRW modular, solid, dry-cast concrete blocks based on:
1. Unilock:
 - a. PISA
 2. As manufactured by:
Unilock
Uxbridge MA, Brewster NY, Rittman OH, Brighton MI, Aurora IL, Marengo IL, Elkhorn WI, Ayr ON, Georgetown ON, Pickering ON, Gormley ON
- B. Product requirements:
1. SRW: PISA
 - a. Color: Sierra Blend
 2. SRW Coping: PISA
 - a. Color: Sierra Blend
- C. Provide SRW meeting the requirements set forth in ASTM C1372.
- D. Provide SRW meeting the physical properties listed below as tested using ASTM C140:
1. Dimensional tolerance shall be +/- 3 mm (1/8 in.) for height, width, and length.
 2. The minimum 28-day compressive strength of 35 MPa (5000 psi).
 3. The maximum moisture absorption shall be 1.0 kN/cubic m (6.5 lbs/cubic ft).
- E. Provide SRW utilizing an integral shear key connection with offset to create:
1. Battered wall
 2. Near vertical wall
- F. Accept only pigments in concrete pavers conforming to ASTM C 979.
Note: ACI Report No. 212.3R provides guidance on the use of pigments.

2.03 LEVELING BASE AGGREGATE

- A. Provide non-frost susceptible, well-graded, compacted angular gravel-sand mixture (GW as per ASTM D2487) Leveling Base conforming to ASTM D 2940 and gradation requirements as presented in Table 1.

TABLE 1
LEVELING BASE AGGREGATE
GRADATION REQUIREMENTS

ASTM D 2940	
Sieve Size	Percent Passing

2 in (50 mm)	100
1-1/2 in (37.5 mm)	95 to 100
3/4 in (19 mm)	70 to 92
3/8 in (9.5 mm)	50 to 70
No. 4 (4.75 mm)	35 to 55
No. 30 (600 µm)	12 to 25
No. 200 (75 µm)	0 to 8*

* In order to prevent damage by frost heaving, it may be necessary to limit the percentages of material passing the No. 200 sieve to less than shown in the tables.

2.04 BACKFILL AGGREGATE

- A. Provide Base Aggregate materials conforming to ASTM D 2940 and gradation requirements as presented in Table 2.

**TABLE 2
BACKFILL AGGREGATE
GRADATION REQUIREMENTS**

ASTM D 2940	
Sieve Size	Percent Passing
2 in (50 mm)	100
1-1/2 in (37.5 mm)	95 to 100
3/4 in (19 mm)	70 to 92
3/8 in (9.5 mm)	50 to 70
No. 4 (4.75 mm)	35 to 55
No. 30 (600 µm)	12 to 25
No. 200 (75 µm)	0 to 8*

* In order to prevent damage by frost heaving, it may be necessary to limit the percentages of material passing the No. 200 sieve to less than shown in the tables.

2.05 DRAINAGE AGGREGATE FILL

- A. Provide Drainage Aggregate materials conforming to ASTM C 33 and gradation requirements of ASTM D 448 No. 8 as presented in Table 3.

**TABLE 3
DRAINAGE AGGREGATE
GRADATION REQUIREMENTS**

ASTM No. 8	
Sieve Size	Percent Passing
½ in (12.5 mm)	100
3/8 in (9.5 mm)	85 to 100

No. 4 (4.75 mm)	10 to 30
No. 8 (2.36 mm)	0 to 10
No. 16 (1.18 mm)	0 to 5

2.06 UNDERDRAINAGE PIPE

- A. Provide a minimum 100 mm (4 inches) Underdrainage Pipe using:
 - 1. Perforated corrugated high density polyethylene (HDPE) meeting ASTM F667.
 - 2. Perforated polyvinyl chloride (PVC) pipe meeting ASTM D3034.
- B. Protect with Geotextile Fabric to prevent the migration of soil particles into the Underdrainage Pipe.

2.07 GEOTEXTILE FABRIC

- A. Provide Geotextile material conforming to the following performance characteristics, measured per the test methods referenced:
 - 1. 4 oz., nonwoven needle punched geotextile composed of 100% polypropylene staple fibers that are inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids.
 - 2. Grab Tensile Strength: ASTM D 4632: 115 lbs.
 - 3. Grab Tensile Elongation: ASTM D 4632: 50%
 - 4. Trapezoidal Tear: ASTM D4533: 50 lbs.
 - 5. Puncture: ASTM D4833: 65 lbs.
 - 6. Apparent Opening Size: ASTM D 4751: 0.212 mm, 70 U.S. Sieve
 - 7. Permittivity: ASTM D 4491: 2.0 sec -1
 - 8. Flow Rate: ASTM D 4491: 140 gal/min/s.f.

Geotextile Fabric meeting these requirements include:

- 1. Carthage Mills – FX-40HS
- 2. U.S. Fabrics – US 115NW
- 3. Mirafi – 140N

2.08 GEOSYNTHETIC REINFORCEMENT

- A. Provide Geosynthetic Reinforcement as supplied by Manufacturer
 - 1. Stratagrid SGU 60
 - 2. Stratagrid SGU 100
 - 3. Gator Grid 30-30
 - 4. Gator Grid 50-50

2.09 CONCRETE ADHESIVE

- A. Provide a Concrete Adhesive manufactured by the following:
 - 1. LePage:
 - a. Product Type: PL Premium Polyurethane construction adhesive
 - b. LePage PL 9000 Heavy Duty construction adhesive
 - 2. Alliance:
 - a. Product Type: Gator Glue XP Polyurethane construction adhesive
 - 3. Unilock Concrete Adhesive
 - 4. PolyBind XP Polyurethane Adhesive

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas indicated to receive SRW for compliance with requirements for installation tolerances and other conditions affecting performance for the following items:
 - 1. Verify that subgrade preparation, compacted density and elevations conform to minimum specified requirements.
 - 2. Verify all site services are located outside of SRW construction area unless otherwise noted.
 - 3. Verify that the Base Aggregate material, thickness, compacted density, surface tolerances and elevations conform to specified requirements.
 - 4. Verify the Leveling Base Aggregate horizontal alignment conforms to the SRW alignment.
 - 5. Provide written density test results for soil subgrade, Base Aggregate materials to the Owner, General Contractor and SRW installation subcontractor.
 - 6. Verify that the subgrade soil is free from standing water.
 - 7. Verify the SRW structure or excavation limits are within property boundaries and do not cross into adjacent properties unless approved prior to construction.
 - 8. Verify the SRW drainage system delivers outflow to approved location.
 - 9. Verify the SRW and associated excavation remains outside of the loading influence of other adjacent structures and ensure stability of excavations and conformance with applicable regulations.
- B. Geotechnical Inspection.
 - 1. Verify soil parameters and groundwater conditions are acceptable for SRW.
 - 2. Verify subgrade Bearing Capacity meets or exceeds values required for area to receive SRW.
 - 3. Identify groundwater conditions and/or other water source prior to SRW installation. Note additional water sources such as seepage from the cut embankment.
 - 4. Ensure that surface water runoff and/or other sources of water are being controlled during construction and directed away from the SRW to a functioning drain.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Beginning of Universal Base Units signifies acceptance of the subgrade soil elevations.

3.02 CONSTRUCTION TOLERANCES

- A. Installation of SRW facia shall be within all the following acceptable tolerances:
 - 1. Vertical Control: +/- 1.25 inches over a 10 ft distance
 - 2. Horizontal Control: Straight lines: +/- 1.25 inches over a 10 ft distance
 - 3. Rotation of the SRW face: Maximum 2.0 degrees from established SRW plan batter or +/-10.0% from total established horizontal setback
 - 4. Bulging: +/- 1.25 inch over a 10 ft distance

3.03 CONSTRUCTION

- A. SITE PREPARATION
 - 1. Comply with all current Federal, Provincial/State, and local regulations for execution of the work, including local building codes and excavation regulations. Provide excavation support as required to maintain stability of the area during excavation and SRW construction and to protect existing structures, utilities, landscape features, property, or improvements.
 - 2. Prior to grading or excavation of the site, confirm the location of the SRW and all underground features, including utility locations within the area of construction. Ensure surrounding structures are protected from effects of SRW excavation.
 - 3. Coordinate installation of underground utilities with SRW installation.
 - 4. Control surface water drainage and prevent inundation of the SRW construction area during the construction process.

5. Excavate the foundation soil to the required grades. Trim the subgrade to within 0 to ½ in. (0 to 13mm) of the specified grades. Do not deviate the surface of the prepared subgrade by more than 3/8 in. (10mm) from the bottom edge of a 39 in. (1m) straight edge laid in any direction.
 6. Excavated the native soils to the lines and grades indicated in cut situations. Document and remove from the site.
 7. Prevent excavated soils being reused onsite from contamination or overly saturate the stockpiled fill material.
 8. Prevent damage to underdrain pipes, overflow pipes, observation wells, or inlets and other drainage appurtenances during installation. Report all damage immediately.
 9. Compact soil subgrade uniformly to at least 95 percent of Standard Proctor Density per ASTM D 698. Stabilization of the subgrade and/or base material may be necessary with weak or saturated subgrade soils.
 10. Do not proceed with further SRW construction, under any circumstances, until the subgrade has been inspected.
- B. GEOTEXTILE FABRIC
1. Provide separation geotextile on bottom and sides of prepared soil subgrade. Secure in place to prevent wrinkling or folding from equipment tires and tracks.
 2. Overlap ends and edges a minimum of 18 in. (450 mm) in the direction of drainage.
- C. LEVELING BASE AGGREGATE
1. Spread Leveling Base aggregate in areas indicated for SRW in accordance with horizontal and vertical alignments.
 2. Compact the Leveling Base Aggregate material with at least two passes per lift using a vibratory plate compactor applying a minimum of 4,000lbs.(18kN) over compacted subgrade soil material. Compact to at least 98 percent Standard Proctor Density as per ASTM D 698.
 3. Tolerance: Do not exceed the specified surface grade of the compacted Base Aggregate material more than ±3/8 in. (10 mm) over a 10 ft. (3 m) long straightedge laid in any direction.
- D. INSTALLATION OF SEGMENTAL RETAINING WALL UNITS
1. Place the SRW bottom row in the middle of the Leveling Base. Ensure the SRW Units are aligned properly, leveled from side to side and front to back, and in complete contact with the Leveling Base.
 2. Interconnect the SRW shear key creating the specified batter of the SRW face.
 3. Sweep the SRW top clean before placing additional courses to ensure that no dirt, concrete, or other foreign materials become lodged between successive lifts.
 - a. Place Geosynthetic Reinforcement as required.
 4. Offset SRW units to create a running bond pattern with the edge of all units being approximately aligned with the middle of the unit in the course below it. Place cut SRW half units to ensure the vertical line between adjacent SRW units remains within the middle third of the SRW unit below.
 5. Provide Drainage and Backfill Aggregate once three courses above grade have been placed. Backfill with additional aggregates after a maximum of three courses of SRW units have been placed above the previous Backfill and Drainage Aggregate level.
 6. Verify no gaps are formed between successive lists affection performance and correct before proceeding with additional lists.
 7. Ensure SRW Units and Geosynthetic Reinforcement are not damaged during handling and placement.
 8. Prevent heavy equipment, for compaction, fill placement or other, within 1 meter (3 ft.) from back of the SRW Units.
- F. DRAINAGE SYSTEM

1. Place the Geotextile Fabric against the back of the first SRW Unit, over the prepared foundation soil extending towards the back of the excavation, up the excavation face and eventually over the top of the Drainage Fill to the back of the SRW Units near the top of the wall. Overlap Geotextile minimum of 300 mm (1 ft.) and shingle down the face of the excavation in order to prevent the migration.
 2. Provide Underdrainage Pipe in accordance with the overall drainage plan for the site. Slope Underdrainage Pipe to ensure gravity flow of water from the Backfill Aggregate. Connect Underdrainage Pipe at a storm sewer catch basin or daylight along slope at an elevation lower than lowest point of pipe within Backfill Aggregate mass, every 15 m (50 feet) maximum.
 3. Install chimney or blanket drains if other sources of water are discovered during excavation or anticipated.
 4. Fill and cover the Underdrainage pipe and trench with Drainage Aggregate and Geotextile fabric.
- G. DRAINAGE FILL
1. Provide Drainage Fill between the back of wall and Backfill Aggregate.
 2. Place a minimum width of 150 mm (6 in.) and separated from other soils using the specified Geotextile Fabric.
 3. Place Drainage Fill behind the SRW facing in maximum lifts of 150 mm (6 inches) and compacted to a minimum density of 95% Standard Proctor.
- H. BACKFILL AGGREGATE
1. Provide Backfill Aggregate behind SRW and Drainage Fill with a maximum lift thickness of 150 mm (6 inches) and compacted to a minimum density of 95% Standard Proctor Maximum Dry Density (ASTM D698) at a moisture content from 2% below to 2% above optimum.
 2. Slope the last lift of Backfill Aggregate away from the SRW facing to rapidly direct runoff away from the SRW at the end of each day's operation. Prevent surface runoff from adjacent areas to enter the SRW construction area.
- I. GEOSYNTHETIC REINFORCEMENT (for SRW walls over 30 inches tall)
1. Verify type and primary strength direction of the Geosynthetic Reinforcement.
 2. Sweep the top of the SRW Units to ensure the SRW Units are clean and free of debris.
 3. Cut Geosynthetic Reinforcement in sheets to the length shown in the Construction Documents.
 4. Place Geosynthetic Reinforcement sheets horizontally with the primary strength direction perpendicular to the SRW face and adjacent sheets without overlapping and without gaps between them.
 5. Ensure each Geosynthetic Reinforcement layer corresponds with the correct elevations and Drainage Fill is level to prevent voids.
 6. Place the Geosynthetic Reinforcement over the compacted Backfill Aggregate and the SRW Units with the outside edge extending over the shear key of the SRW Unit to within 25 mm (1 in.) of the front facing unit.
 7. Carefully place subsequent SRW Units on top of the lower course to ensure that no pieces of concrete are chipped off and become lodged between courses. Ensure the Geosynthetic Reinforcement is in complete contact with the top and bottom surfaces of the successive SRW courses.
 8. Pull Geosynthetic Reinforcement taut away from SRW Units during Backfill Aggregate placement. Provide Geosynthetic Reinforcement anchoring pins or staples to ensure that there are no wrinkles or slackness prior to Backfill Aggregate placement. Ensure Geosynthetic Reinforcement lays flat when pulled back perpendicular to the back of the SRW.

9. Prevent construction equipment from operating directly on top of the Geosynthetic Reinforcement until a minimum thickness of 150 mm (6 inches) of Reinforcement Fill has been placed.
 10. Prevent heavy equipment from within 1 meter (3. Ft.) of the back of the SRW Units.
 - J. RETAINED FILL
 1. Provide compacted Retained Fill behind the Backfill Aggregate or Drainage Fill in maximum lift thickness of 150 mm (6 inches).
 - K. SECURE COPING
 1. Sweep the last SRW course clean of all debris.
 2. Secure SRW Coping to SRW Units with two 10 mm (3/8 inch) beads of Concrete Adhesive positioned 50mm (2 inches) in front and behind the groove of the last course of SRW Units.
 - L. FINISHING SRW
 1. Finish grading above SRW to direct surface runoff water away. Grade a swale above the SRW sloping away from back of the wall. Establish final grading immediately to ensure and protect the Backfill Aggregate from water infiltration.
 2. Prevent additional structures (fences, handrails, vehicular guardrails, buildings, pools/ponds, etc.) or changes to grading/loading (increased height, slopes, parking areas, changes in proximity to water flow, etc.), other than those shown in the Construction Documents, from being installed.
 3. Prevent landscaping activities within the Reinforcement Fill to ensure:
 - a. The Geosynthetic Reinforcement is not damaged by excavation for the root ball
 - b. The SRW is not subjected to any additional load from plants or trees.
- 3.04 REPAIRING AND CLEANING
- A. Remove and replace SRW Coping Units that are chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
 - B. Cleaning: Remove excess dirt, debris, stains, grit, etc. from exposed SRW Units; wash and scrub clean.
 1. Clean SRW Units in accordance with the manufacturer's written recommendations.
- 3.05 PROTECTION
- A. Protect completed work from damage due to subsequent construction activity on the site.

END OF SECTION 32 32 23

SECTION 32 90 00

PLANTING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide trees, plants and ground cover as shown and specified. Work includes:
 - 1. Trees, plants and ground cover.
 - 2. Soil amendments, planting soil mixtures and accessories.
 - 3. Provide additional topsoil as required for planting soil backfill in plant pits and planting beds, or as noted on the drawings.
 - 4. Provide maintenance of all plants and transplants until final acceptance.
- B. A plant list, including a schedule of sizes, quantities and other requirements, is provided on the drawings.
- C. Related work:
 - 1. Section 31 10 00: Site Clearing
 - 2. Section 31 20 00: Earth Moving

1.2 QUALITY ASSURANCE

- A. Plants shall conform to names indicated on the drawings and plant list and to the nomenclature listed in the American Joint Committee on Horticultural Nomenclature's "Standardized Plant Names", latest edition.
- B. Size, quality, handling, planting and maintenance of plant materials shall be in accordance with "USA Standard of Nursery Stock", American Association of Nurserymen, Inc. Minimum acceptable sizes of plants, measured before pruning with branches in normal position, shall conform to measurements specified in the plant list.
- C. Plants shall be subject to the Landscape Architect's inspection and approval at place of growth or upon delivery for conformity to specification requirements. Such approval shall preclude neither right of inspection upon delivery at the site or during progress of work, nor right of rejection at the site due to damage suffered in handling or transportation.
- D. Contractor will provide and pay for materials testing. Testing agency shall be acceptable to the Landscape Architect.
 - 1. Test representative samples of materials proposed for use. Materials used in the work shall be the same materials as tested. Do not use proposed materials in the work until test reports have been reviewed by the Landscape Architect and approval obtained to proceed with plant excavations.
- E. Test reports: Provide the following information:
 - 1. Topsoil:
 - a. Mechanical analysis
 - b. Percentage of organic content
 - c. Recommendations on the type and quantity of soil nutrient additives required to bring nutrients to a satisfactory level for specified plants.
 - d. Recommendations on the type and quantity of soil additives required to bring the pH of soil to a value of 6.5-7.0 (unless otherwise noted).
 - 2. Peat Moss:
 - a. Loss of weight by ignition
 - b. Moisture absorption capacity

3. If on-site topsoil is used, provide a minimum of 4 separate tests to verify mechanical analysis, organic matter content, nutrient level and pH value of topsoil. Sample locations as directed by the Landscape Architect.

1.3 SUBMITTALS

- A. Submit complete written maintenance instructions at least 10 days prior to end of maintenance period. Include all requirements for proper care, development and maintenance of plantings.
- B. Submit samples of proposed mulch used in planting beds for approval.
- C. Submit certificate of inspection of plant material by state or federal authorities.
- D. Submit a label from the manufacturer's container certifying fertilizer content.
- E. Submit material test reports and soil nutrient additive recommendations.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Prepare, transport and handle plants to ensure protection against injury. Cover all plants while transporting to and from the site.
- B. Deliver plants with legible waterproof identification labels.
- C. Temporary storage of new material:
 1. No new plants shall remain in temporary storage over the winter or summer. Plants that are not planted immediately shall be protected as follows:
 - a. Plants shall remain on the site of the work no longer than three days prior to being planted or placed in storage.
 - b. The earth balls shall be kept moist and their solidity carefully preserved. To prevent drying out or freezing, store plants in a compact group with a suitable mulch material placed around and between the balls so they are completely covered. The duration of storage, method of storage of plants and mulch material shall be acceptable to the Landscape Architect.
- D. Do not deliver or use topsoil in frozen or muddy condition.

1.5 JOB CONDITIONS

- A. Install plant materials during time periods indicated. Planting operations conducted at other times are at the option and full responsibility of the Contractor and without additional compensation, except as otherwise agreed to by the Landscape Architect and Owner.
 1. Deciduous materials:
 - a. March 1 to June 1
 - b. October 1 to December 1
 2. Evergreen material:
 - a. April 1 to June 1
 - b. September 1 to October 15
 3. Ground Cover: Spring only, unless otherwise authorized.
 4. When planting operations vary, plant early in the day. When planting occurs in the summer, apply anti-desiccant spray to plantings after leaves become full size.
- B. Weather limitations: Proceed with planting only when existing and forecasted weather conditions permit.
- C. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Landscape Architect.
 1. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

2. When hydroseeding is used, protect shrubs, trees and other site improvements from hydroseed overspray. Any improvements damaged by overspray will be repaired or replaced by the responsible contractor.

1.6 GUARANTEE

- A. Guarantee unconditionally labor and plant materials for a period of one year after Landscape Architect's acceptance. Replace at Contractor's expense all plant materials which die during guarantee period, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner. At end of guarantee period, replace all plant materials that are more than 25 percent dead or in an unhealthy condition.
- B. During guarantee period, replace plants that die or are, in the Landscape Architect's opinion, in an unhealthy, unsightly, or badly impaired condition. Make no replacements in any season unfavorable for planting. Provide replacement plants of the same kind and size as specified in the plant list, and meeting all requirements of these specifications.
- C. Initial inspection of planting will be made by Landscape Architect at completion of planting. Guarantee period shall begin at date of acceptance.
- D. The Contractor shall make as many periodic inspections as necessary during the guarantee period at no additional cost to the Owner, to determine if the Owner's maintenance program is providing satisfactory care for the new plant materials. Submit in writing to the Owner all recommended changes.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Plant Materials:
 1. Provide healthy, sound, vigorous plant materials, free from plant diseases, insect pests, or their eggs, with healthy well-developed root systems; freshly dug, nursery-grown, well-branched, densely foliated when in leaf, and well-proportioned, particularly with respect to the width-height relationship, hardy under climatic conditions similar to those of the project.
 2. Damaged or broken branches, broken ball, and loose top in ball are not acceptable. Provide balled and burlapped plants, designated B&B, adequately balled with firm natural balls as set forth in the ASNS. Firmly wrap balls with burlap or approved cloth secured in place.
 3. Obtain the Landscape Architect's specific written approval for substitution of plants other than those named in the plant list. Proposed substitutes shall have essentially the same characteristics as plants specified in appearance, ultimate height, shape, habit of growth, general soil and other requirements. Average cost and value of substituted plants shall be no less than cost and value of plants specified. Plants of greater value may be accepted without additional cost to the Owner.
 4. Provide container-grown stock with root system sufficiently developed to hold soil together, firm and whole. No plants shall be loose in containers; nor pot-bound.
 5. Size range and measurement of height and caliper of all material shall be as specified in the ASNS.
- B. Guying and Staking Material:
 1. Tree stakes: 2" x 2" x 8' hardwood.
 2. Hose: High quality braided rubber or plastic hose, 3/4 inch diameter and suitable length. (Color Black)
 3. Wire: 12 gauge galvanized steel.
 4. Guying cable: Galvanized steel, #9 gauge. Thimbles and nicroress clips shall be used for connections and splices.

5. Turnbuckles: Galvanized or zinc dip painted with an 8 inch length-wise opening fitted with eyebolts and spot welded or fitted with a locking device to prevent vandalism.
 6. Guying stakes: 2" x 2" x 33", notched hardwood.
 7. Deadman: Sound lumber 4" x 8" x 36".
- C. Mulch:
1. Paygro or equal, shredded bark mulch or wood chips, containing no sticks larger than 1/4" in diameter, stones, clay or other foreign material that will prevent eventual decay of the mulch necessary for its complete effectiveness.
 2. Gravel mulch as noted on the plans shall be washed river rock, size as noted. It shall be inert, durable stone free of material deleterious to plant growth. Submit sample to Landscape Architect for approval.
- D. Wrapping material for tree trunks: Two thickness' of crinkled paper cemented together with bituminous material, in strips 4" to 6" wide, laced in place.
- E. Anti-desiccant: "Wilt-Pruf", Nursery Specialty Products, Inc., New York or equal. Use according to manufacturer's instructions.
- F. Tree Paint: Cabot Tree Paint or equal.
- G. Peat moss used in planting soil preparation: High quality pure Canadian sphagnum peat with a pH value not less than 3.5 nor greater than 6.0 at 25 degrees C. The ash content shall be not more than 10 percent and water holding capacity shall be not less than 800 percent.
- H. Water: Free of substances harmful to plant growth.
- I. Fertilizer mixture: At the time of plant installation, add fertilizer mixture into the planting soil. 100 lb. of fertilizer mixture consists of the following:
- | |
|--|
| 3 pounds chelated iron (Sequestrene) |
| 5 pounds aluminum sulfate |
| 7 pounds finely ground sulphur |
| 10 pounds steamed bonemeal |
| 75 pounds complete fertilizer, such as 8-32-16 |
- J. Topsoil:
1. Provide fertile, friable, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter and free of roots, stumps, stones, and other extraneous or toxic matter harmful to plant growth.
 2. Topsoil shall be a sandy loam or loam soil as defined by the Soil Conservation Service U.S.D.A., Soil Classification System.
 3. Mechanical analysis shall fall within the following particle ranges:
- | Average percentage | Range | |
|--------------------------------------|--------|-----|
| Sand (.05-2.0 mil dia. Range) | 30-70% | 50% |
| Silt (0.002-0/05 mil dia. Range) | 20-50% | 35% |
| Clay (less than .002 mil dia. Range) | 5-25% | 15% |
- 95% of topsoil shall pass a 2.0 mil sieve.
4. Provide topsoil free of stones one inch in longest dimension, earth clods, plant parts and debris.
 5. Topsoil shall possess from 5% to 12% organic matter.
- K. Landscape Mat: When specified on the drawings, landscape mat shall be DeWitt Pro 5 Weed Barrier polypropylene fabric mat 4.8 oz. per square yard as manufactured by DeWitt Company, phone: (800) 325-0950 or approved equal. Joints shall be lapped 4"-6" with care taken not to puncture or tear mat.

2.2 PLANTING SOIL MIXTURE

- A. Planting soil mixture: For all planting operations, provide 4 parts topsoil and 1 part peat moss by volume.
- B. Planting soil shall have a pH value range of 6.5 to 7.0. If the topsoil used in making the planting soil mixture does not fall within the pH range specified, amend with limestone or aluminum sulphate to bring topsoil within the specified limit.

- C. Test topsoil to be used in making planting soil mixture for nutrients. When testing indicates a deficiency of nutrients, apply fertilizer at rates recommended by testing.
- D. Apply fertilizer recommended by testing within a ten day period prior to installing plants.

PART 3 EXECUTION

3.1 GENERAL

- A. Examine the areas and conditions under which the work is to be performed. Provide the required additional topsoil in all planting areas. Do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Locate plants as shown or as approved in field by Landscape Architect after staking by Contractor.

3.2 BED PREPARATION

- A. Unless otherwise directed by the Landscape Architect, incorporate 5 pounds of specified fertilizer mixture per cubic yard of planting soil mixture.
- B. Test drain plant beds and pits by filling with water twice in succession. Conditions permitting retention of water in planting beds for more than 24 hours shall be brought to the Landscape Architect's attention. Notify Landscape Architect in writing of condition considered detrimental to growth of plant materials, and submit proposal for correcting condition, if feasible, including change in cost, if any.
- C. Excavate plant pits with vertical sides. Make tree pits 2 ft. greater in diameter than ball of earth or spread of roots of trees and deep enough to allow for depth of ball. Make shrub pits 1 ft. greater than spread of roots and 12" deep minimum, below finished grade. Adjust depth of planting beds to permit a minimum of 4" of tamped topsoil beneath ball or roots of all plants. Set plants at finished grade.
- D. Remove all rock or other underground obstruction encountered in any plant pit excavation to a depth of not less than 3 ft. below grade and not less than 6" below bottom of ball or roots.

3.3 PLANT INSTALLATION

- A. Set plants in center of pits plumb and straight and at such a level that after settlement, plants will bear same relation to finished grade of surrounding ground as to grade of ground from which plants were dug. In setting balled and burlapped trees and shrubs, compact topsoil around bases of ball to fill all voids. Remove ropes, wires or strings.
- B. Thoroughly compact and water topsoil around balls. To compensate for shrinkage, fix finished grade of topsoil prior to watering at an elevation 10% of fill depth higher than desired finished grade. To facilitate watering, form shallow saucer approximately 3" deep around each plant by placing a ridge of topsoil around the edge of each filled-in pit. After planting, cultivate soil in shrub beds between shrub pits, rake smooth and neatly outline.
- C. Wrap all trees immediately after planting. Wrap tree trunks spirally from bottom to top and entirely cover trunk from ground to height of second branches neatly and snugly. Overlay approximately 2". Stake or guy as shown on drawings.
- D. Prune each tree and shrub in accordance with the American Association of Nurserymen's Standard to preserve natural character of plant. Remove all dead wood or suckers and all broken or badly bruised branches. Remove 1/4 to 1/3 of wood by thinning out and shortening branches to balance root loss due to transplanting. Make all cuts flush, leaving no stubs. Paint cuts over 1" diameter with tree paint, covering all exposed cambium and other exposed living tissue.
- E. Within 2 days after planting, cover all tree shrub and ground cover pits and beds with a minimum 3" layer of mulch. Limit of mulch for trees shall be area of pit, and for shrubs and

ground cover in beds, entire area of bed. Where gravel mulch is specified, avoid contaminating gravel with other materials. Temporary edging material, where shown on the drawings, shall be removed after adjoining ground cover materials have become established.

3.4 MAINTENANCE OF PLANTING

- A. Maintenance shall begin immediately after each plant is planted and shall continue until final acceptance with the following requirements: Maintenance of new planting shall consist of pruning, watering, cultivating, weeding, mulching, tightening, and repairing of guys, resetting plants to proper grades and upright position, restoration of guys, resetting plants to proper grades and upright position, restoration of the planting saucer, and furnishing and applying such sprays as are necessary to keep the plantings free of insects and disease.
- B. Planting areas and plants shall be protected at all times against trespassing and damage for the duration of the maintenance period. If any plants become damaged or injured, they shall be treated or replaced as directed by the Landscape Architect at no additional cost to the Owner.

3.5 INSPECTION AND ACCEPTANCE

- A. The work will be inspected upon Contractor's written request submitted at least 10 days before anticipated date of inspection. Repairs or replacements deemed necessary after inspection, shall be completed before acceptance is made by the Landscape Architect.
- B. The work may be accepted in parts when it is deemed to be in the Owner's best interest to do so, and when permission is given to the Contractor in writing to complete the work in parts.
- C. The guarantee period for trees and shrubs shall begin at the date of acceptance. All plant material shall be guaranteed by the Contractor, for a period of one year from the date of acceptance to be in good, healthy and flourishing condition. When the work is accepted in parts, the guarantee periods shall extend from each of the partial acceptances to the terminal date of the last guarantee period. Thus, all guarantee periods terminate at one time.
- D. The Contractor shall replace, without cost to the Owner, and as soon as weather conditions permit and within a specified planting period, all dead plants and all plants not in a vigorous, thriving condition, as determined by the Landscape Architect during and at the end of the guarantee period. The plants shall be free of dead or dying branches and branch tips, and shall bear foliage of a normal density, size and color. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this specification. The Contractor shall make all necessary repairs due to plant replacements. Such repairs shall be done at no extra cost to the Owner. The Guarantee of all replacement plants shall extend for an additional period of one year from the date of their acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of the said extended guarantee period, the Owner may elect subsequent replacement or credit for each item.

3.6 ADJUST AND CLEAN

- A. Upon completion of planting and prior to acceptance, remove excess soil and debris from site and repair all damage to structures and site improvements, resulting from planting operations.
- B. Sweep and hose down paved surfaces affected by planting operations.

END OF SECTION 32 90 00